ST. GEORGE'S HALL

Crown Court

169 feet

Civil Court

GROUND PLAN

10 20 30 40 50 60 70 80 90 FEET.

THE ASSIZE COURTS & ST. GEORGE'S HALL, LIVERPOOL.

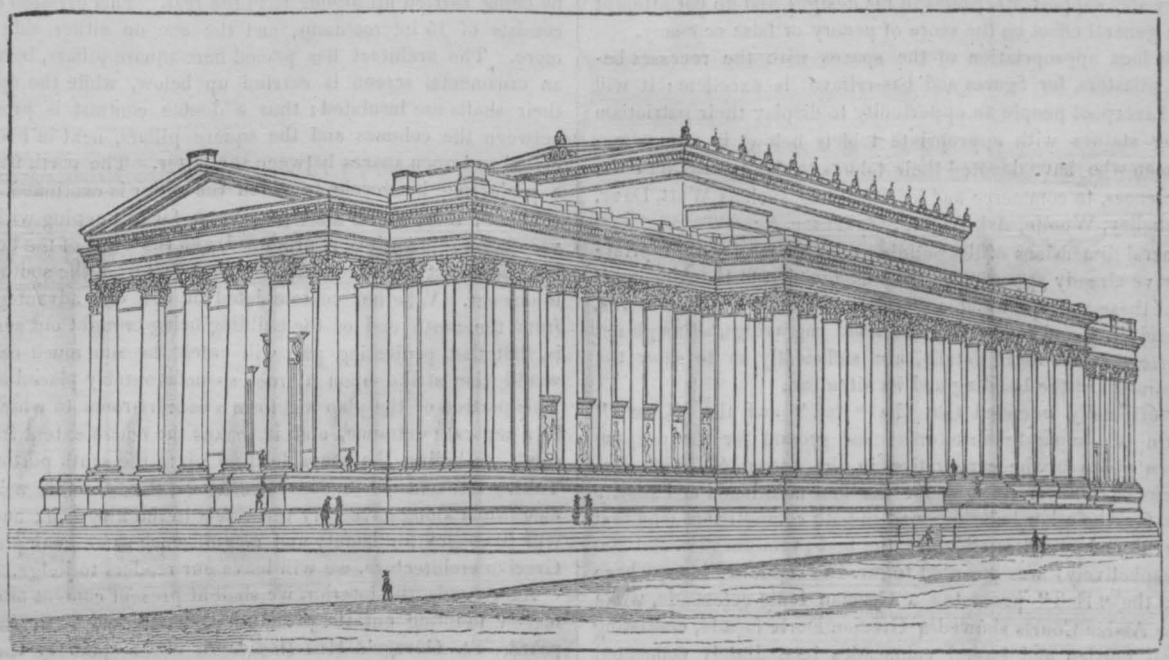
ARCHITECT H. LONSDALE ELMES.

J.H. Banks, Sc.t 21 Tonbridge Place, Kings Cross.

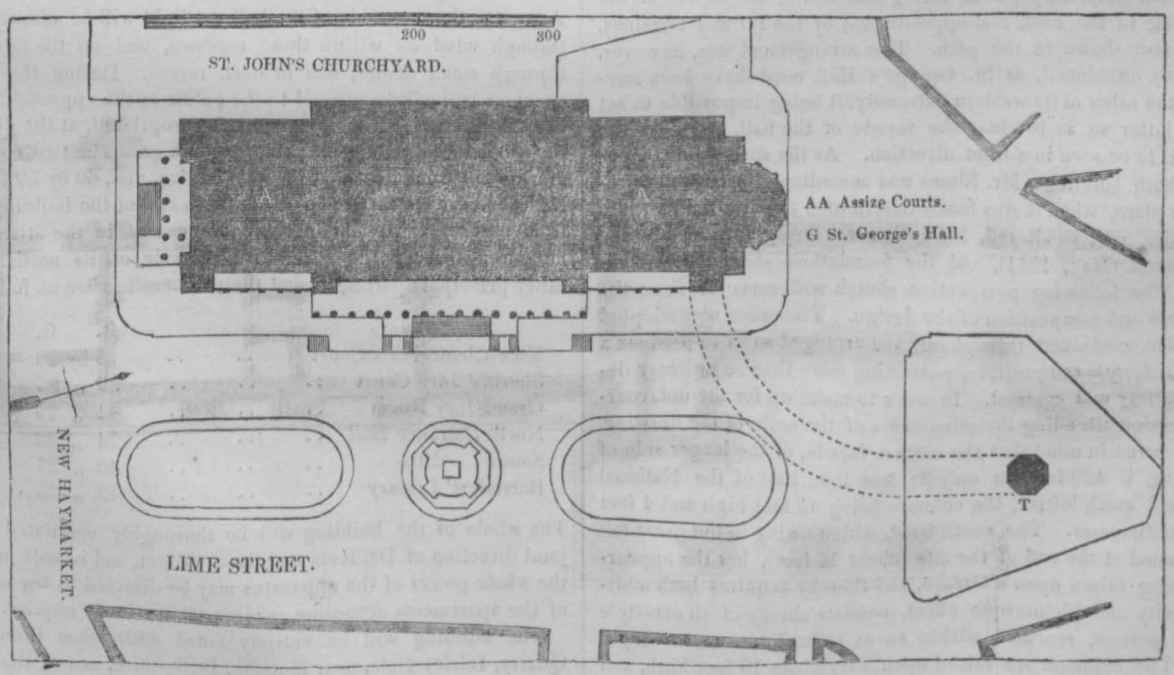
ST. GEORGE'S HALL AND THE ASSIZE COURTS, LIVERPOOL.

H. LONSDALE ELMES, Architect.

(With an Engraving, see Plate XII.)



Perspective View.



Block Plan of Situation.

IT affords us much pleasure to be able to furnish our readers, through the kindness of the talented architect Mr. H. Lonsdale Elmes, with a copper-plate engraving of the principal façade of St. George's Hall, Liverpool, now in course of erection, and which, when finished, will justly be the pride of Liverpool; and from what we have seen of the designs of the interior, we can safely say that it will stand pre-eminently as one of the most noble buildings of this country. It is a pleasure to find, which we desire to see more general, that the Committee very ably support Mr. Elmes in his designs, and do not attempt to mar the general effect on the score of penury or false economy.

The judicious appropriation of the spaces with the recesses between the pilasters, for figures and bas-relievo is excellent; it will afford the Liverpool people an opportunity to display their patriotism by erecting statues with appropriate tablets below, in commemoration of men who have devoted their talents to the extension of the arts and sciences, to commerce and manufactures, such as Watt, Davy, Dalton, Brindley, Woolfe, Arkwright, Stephenson, &c.

The general dimensions of the building, with some very appropriate remarks, have already appeared in the "Companion to the Almanac" for 1842, of these, and the wood engravings, we shall avail ourselves, with some addition and correction; the wood engravings, although not strictly correct in all their details, are sufficiently so to show the general character of the building and its situation.

IT was originally intended that the "Hall" and the "Courts" should form two separate structures; and ground for the purpose having been given by the corporation in the spring of 1839, premiums were offered for designs for the first-mentioned and shortly afterwards for the other building; and in both competitions (the first of 75, the second of 86 candidates) the first premium (250 and 300 guineas respectively) was awarded to Mr. H. Lonsdale Elmes, whose design for the "Hall" presented a Grecian Ionic colonnade, while that for the Assize Courts showed a Grecian Doric façade, consisting of a central portico and lateral colonnades immediately connected with it. According to the instructions first given, St. George's Hall was to have been on the site near T in the annexed block plan of the situation, while the courts would have been as at present, so that the two buildings would have stood at right angles to each other, the "Hall" with its principal front facing the south, the façade of the courts being to the east, and opposite that of the railway terminus, which is also shown in the plan. This arrangement was, however, subsequently abandoned, as St. George's Hall must have been *overlapped* by the other at its western extremity, it being impossible to set back the latter so as to clear the façade of the hall, and allow the whole of it to be seen in a front direction. As the successful competitor for both buildings, Mr. Elmes was accordingly instructed to remodel his plans, when it was finally determined to unite the two into a single pile, and, so altered, his design was finally approved by the Town Council (May, 1841), and the foundations shortly after commenced. The following perspective sketch will serve to show the general style and composition of the design. The order now adopted is Corinthian, continued throughout, and arranged so as to produce a very rich *polystyle* composition, possessing more than an ordinary degree of variety and contrast. In order to make up for the unfavourable impression attending the minuteness of the scale of the drawing, it must be borne in mind that the eastern façade, or the longer side of the building, is 420 feet, or only 38 less than that of the National Gallery, and much loftier, the columns being 45 feet high and 4 feet 7 inches in diameter. The south front, which owing to the great fall of the ground at the end of the site (about 16 feet), has the appearance of being raised upon a terrace, and thereby acquires both additional dignity and picturesque effect, consists chiefly of an octastyle diprostyle portico, recessed within so as to make its entire depth 28 feet. The columns are raised upon a stylobate 10 feet high, and continued along the other fronts, and the height from the ground-line to the apex of the pediment is 95 feet, which is only 6 or 7 less than that of the dome of the National Gallery. This front alone would constitute an imposing piece of architecture—and is upon a scale greatly surpassing anything of the kind yet erected in the metropolis —yet it appears little more than a subordinate portion of the whole when compared with the eastern façade. Independently of its beauties of design, this latter has the merit of clearly expressing the general internal arrangement of the plan: the advanced or monoprostyle colonnade in the centre is 200 feet in length, and, being recessed, forms within an ample sheltered ambulatory 26 feet in depth; this corresponds with St. George's Hall, which comes in between the two Assize Courts, and defines itself externally in the composition, by being carried up higher than the rest. This division of the front consists of 15 intercolumns, and the one on either side of it of 5 more. The architect has placed here square pillars, between which an ornamental screen is carried up below, while the upper part of their shafts are insulated; thus a double contrast is produced, first between the columns and the square pillars, next in respect to the closed and open spaces between the latter. The north front presents a projecting hemicycle in which the order is continued in attached columns; thus, while that part is so far in keeping with the rest, a very agreeable variety is produced, and the view of the building from the north-east differs considerably from that from the south-east, given in our cut. Whether contemplated or not, one advantage resulting from the north end of the building being brought out semicircularly is, that that projecting part will catch the sun much earlier than it would else strike upon a front so unfavourably placed as to aspect. This portion of the plan will form a concert-room to which there will be a separate entrance, and it makes the entire extent from north to south, including the steps leading up to the south portico, 500 feet. Taking into account its unusual altitude, this structure will in point of magnitude alone have very few rivals in the kingdom; and how far it will have any for beauty and magnificence as an example of modern Grecian architecture, we will leave our readers to judge.

As regards the interior, we shall at present content ourselves with merely pointing out its principal divisions and their intended purposes. St. George's Hall (indicated in the plan by the letter G), measuring 169 by 75 feet, and 85 high, will be further extended along the upper part of its sides by a series of recesses 13 feet deep, apparently obtained out of the thickness of the walls, but in reality coming over the corridors which surround this part of the interior, and both separate it from, and connect it with, the two Law Courts AA. On the west side of the hall the light will be admitted laterally through windows within those recesses, and on the opposite one through small domes, one in each recess. During the assizes this spacious hall will be opened to the public as the approach to both the courts. At other times it will be appropriated, at the discretion of the council, to public or private meetings. The two courts, which are lighted from above, are similar in size, viz., 60 by 50 feet, and 45 high; and the concert-room at the north end of the building is 75 feet from east to west, and of the same extent in the other direction, measured through the spacious hemicycle on its north side. The other principal apartments and their dimensions are as follows:—

	ft.	ft.	ft.
Vice-Chancellor's Court	25 by	29	18 high
Sheriffs' Jury Court	29 „	25	18 „
Grand-Jury Room	41 „	25	22 „
North Entrance Hall	74 „	52	30 „
South ditto	40 „	25	19 „
Barristers' Library	42 „	25	18 „

The whole of the building will be thoroughly ventilated under the joint direction of Dr. Reid and the architect, and in such manner that the whole power of the apparatus may be directed to any one or more of the apartments according as circumstances may require.

The building will be entirely faced with stone from Stancliffe Quarry, Darley Dale, near Matlock, Derbyshire, one of the specimens recommended by the Parliamentary Commission for the new Houses of Parliament. It can be obtained in very large blocks, which is an advantage for this style of architecture. Although the columns are 13 ft. from centre to centre, the architraves will be in one length. The great hall is to be vaulted with a semicylindrical vault of solid

brickwork, over a span of 75 feet, and springing at a height from the foundations of 73 feet, the crown of the arch being 110 ft. from the same. It is proposed to extend this permanent mode of construction to the two courts adjoining, which, if executed, will present a grand vista of vaulted ceilings upwards of 300 feet in length. From this we may hope that the architectural character of the exterior will be fully maintained in the interior.

The building is now rapidly advancing, and is carried up as high as the bases of the columns, and the contractor has undertaken to complete the exterior in 1845. The estimated expense, exclusive of ornamental fittings and finishings, is £125,000, of which sum the foundations and basement story have cost nearly £12,000.

CANDIDUS'S NOTE-BOOK.

FASCICULUS LIII.

"I must have liberty
Withal, as large a charter as the winds,
To blow on whom I please."

I. The group of three houses or mansions which are now erecting in Grosvenor Place, on the site of what was the Lock Hospital, although intended to be a superior specimen of the Italian palazzo style, *à la* Barry, with microstylar Ionic windows to the principal floor, as in the Reform Club-house, is very unsatisfactory, owing to the narrowness of the piers between the windows, which certainly do not allow space sufficient for such extended dressings to the windows as are here applied. The consequence is, the fronts look too much overdone in that respect, the parts being so much crowded together, as to lose their value; and the effect cannot, perhaps, be better described than that of a tasteful style treated without taste—which, odd as it may seem to a great many, is by no means an uncommon thing.

Apropos of architectural taste, it seems to be migrating eastward and cityward. There is a new stone-fronted building—as yet unappropriated—just by the church in Lothbury, and facing the Bank, which, though but of moderate size, being only four windows in breadth, is not a little remarkable for general elegance of character, and for careful finish of detail. This charming little specimen of the Italian *palazzo* style, would be an ornament even to Pall-Mall, for except, perhaps, just there, it has not a rival at that end of the town for refined simplicity and gracefulness. It deserves to be noted, also, that though the return on the west side faces a mere alley, the architecture is carried on there consistently with the front.

The new Brighton terminus, with its campanile, near London Bridge, will also, in point of design, be a more than ordinarily tasteful specimen of Italian. The bold rustication of the quoins contribute in no small degree to the expression and finish of the principal building, more especially as it is not confined to the external angles of the façade, but is repeated at those of the slightly projecting breaks, at the ends, in each of which is a door below and a window above; and in the intermediate part there are three windows on a floor.

II. There is, just now, an excessive deal of cant afloat about the moral influence of the fine arts, just as if the fine arts were not worth cultivating for their own sake, without any hypocritical pretence. Fudge! Talk of the moral influence of waltzing, or of the ballet as viewed from the pit at the Opera! I should like to know, if any one could explain it, what has been the amount of moral influence for good of all the fine arts, drama and literature included, in the civilized stages of society. Was the court of Leo. X remarkable for its correct morality? Was the "divine" Raphael himself a bright exemplar of moral purity? Only consider how many Madonnas have been painted from ladies who had qualified themselves for turning Magdalens. If, on the one hand, art has mainly served to perpetuate the puerilities of pagan mythology, so, on the other, it has kept alive the puerilities of papistical superstition. To us, therefore, who can sympathise neither with the one nor the other, it can have little value than what it derives from its mere æsthetic influence. All the rest is but mockery and delusion, carried on by gullibility on the one side, and humbug on the other. If art has no intrinsic worth in itself, and deserves to be encouraged chiefly as a means, not as an end, let us be honestly told so; and let us have done with cant and make-believe, and with all that frothy flummery with which penny-a-liners descant on art for the nonce in newspapers.

III. To what purpose do we take such pains to collect architectural and similar specimens of ancient art; or why should there be such a prodigious cackling on any thing of the kind, no matter how worthless it may be in itself, being brought to light, when some of the finest studies of the kind are neglected as soon as they come into our possession, without being turned to account in any way whatever? The examples, of ancient or antique columns and other architectural ornaments, to be met with either in museums or inserted in Italian buildings of later date, are almost infinite, both as to number and variety, yet who ever condescends to derive a hint from them? There are some fine things of the kind in the British Museum;—which of our architects has taken a lesson from them for any thing he has himself done? Of nearly all our modern buildings in the Grecian and Roman style, the detail looks as if it had been supplied from some "furnishing warehouse" for the purpose, where it is kept ready made. It is just the same with columns and entablatures, and it frequently looks as if they had been bought at different shops, or were very ill-matched. Hence it is little to be wondered at if, so mechanically treated and with such wearisome sameness, those styles have greatly fallen in public esteem within the last few years. Notwithstanding that we know that even the best preserved examples of Grecian architecture are reduced to little more than the skeletons of what they originally were, quite dismantled and shorn of their splendour, and seen, some of them, in all but total eclipse, we content ourselves with copying their *remains*, without attempting to supply those beauties which are no longer to be traced in the faded originals. Perhaps were we to set about making trial of it, we should find that a very great deal might be done with *painted glass*, even in the Grecian or Roman style. It is not to be supposed that any Pecksniff could discover *how* it ought to be done; neither could it be done by adopting Gothic patterns and Gothic character; yet it might be made to have a sufficiently expressive character of its own, by being introduced as a species of *transparent mosaic*. In such case the apertures ought, perhaps, to be double glazed, so that the painted window would show itself only as a mere panel or compartment on the face of the wall, decorated after such fashion—which would, to a certain degree, be a substitute for other polychromy, or else a suitable accompaniment to it.—But it would be a most scandalous innovation.

IV. Much of our modern Anglo-Grecian architecture is chiefly remarkable for extreme *sulkiness* of look; this, however, may be a merit, for it may be strongly characteristic of our unfortunate *climate*. And though the sun does really shine now and then in this country, perhaps about half-a dozen days in the course of the year, its brightest beams cannot dispel the gloom and sulkiness of some of our ultra-classical buildings. We have among us, more especially,

"Him, the great master of the sulky style,"

whose buildings have one and all a strange Mawworm physiognomy, no matter whether it be intended for Grecian or for Gothic.

V. At present, the new Conservative Club-house in St. James' Street does not promise to be very much better than the one in Pall Mall, either as to composition or style; or to be treated with particular gusto. It might have been thought that, coming after such an example as the Reform Club House, a certain spirit of rivalry would have stimulated the members of the Conservative to take care this second time that their building should, if possible, take precedence of the Reform in public opinion, as a finished work of architecture; yet the new Conservative certainly does not challenge comparison with the other, for the architect seems to have most carefully avoided whatever might look like borrowing an idea from Mr. Barry; though he might, allowably

enough, have taken a lesson from him in regard to general refinement of taste. As yet the building is not carried up higher than the top of the ground floor: neither is that portion finished, still enough may be made out to convince us that whatever may be the care with the upper part of the façade, there will be very little beauty below. In fact, the ground floor is not only plain, but rather bald in style, consequently, if much richness be affected elsewhere, there can be but very little general harmony of character. Although the principal floor of a building requires a higher degree of decoration than the one below it, it does not follow that the last is to have scarcely any, or that what there is may be treated as of no importance; on the contrary, well studied and careful detail are there more especially called for, as being in such situation so much more distinctly seen—in fact the only parts that are seen by those passing along on the same side of the way, for in order to have a proper view of the whole of a front and its upper part, it is necessary to look at it from the opposite side of the street. Another reason for paying particular attention to finish in those parts of a building which are nearest to the eye, is that it will be taken for granted that equal care of execution has been bestowed throughout, though the ornaments and details at a distance from the eye may be less highly wrought up—however richer and more ornamental they may be in point of design. All this is, of course, to be taken *grano salis*, because circumstances must decide when and to what extent it is desirable to treat the ground-floor or lower portion of a building as an important part of a composition.

In the case of the new "Conservative," such mode might very well have been adopted, for now, the lower part of the front will be at least very tame, if not decidedly poor, in character, yet at the same time the reverse of sober as to design, for at each end of front is a sort of loggia or recess between two Italian Doric columns, placed excessively wide apart; and one of these recesses, viz., that at the north end, has a second smaller recess within it, also between two columns, and containing the entrance door; while the south one encloses a bay-window, which is segmental on its plan. Owing to the prodigious interval between the columns, these *loggias*, or whatever else they may be called, have the appearance of being square gaps, and that, too, precisely when there ought to have been a decided expression of strength and solidity. In one respect, the building manifests neither originality nor improvement, having mean horizontal stripes after the ordinary fashion of those on the parlour floor fronts of suburban "speculation" houses, without even mouldings of any kind being substituted for rustication. To be sure, this is only matter of taste, but it would be well were such taste wholly exploded, or at any rate abandoned to speculation builders. One vast comfort is, that the façade of the British Museum will make ample amends for all other mishaps—for all our blunderings and all our failures—our National Galleries, Buckingham Palaces, Nelsonian Monuments, and all the rest of the tribe.

THE EPISCOPAL CEMETERY CHAPEL, WISBEACH.

ONE prevalent foible of the age is Fussiness, a sort of bustling, fidgetty, over-acted parade, mixed up with a good deal of maudlin cajolery, manifested ridiculously, and sometimes still more offensively, so that what ought to be works of charity and sober-minded piety, frequently appear, in the eyes of the sober-minded, to be acts of simpering self-laudation, ostentatious display, and almost of self worship. Charity, now-a-days—at least fashionable charity, cannot put its hands into its pocket, without a flourish of trumpets announcing to all the world its own prodigious goodness. A very remarkable instance of the kind occurred at Wisbeach, in August last, when that place presented the spectacle of a general carnival, for about a week, and kept up with great gaiety and carousing, there being a fancy bazaar, ball, concert, picture-exhibition, and, most strange to say, a "grand display" of fire-works, also, on the occasion of laying the first stone of a small cemetery chapel! We had hoped that "fancy bazaars" and all such equivocal—or, we might say, farcical—doings in the aid of charitable or religious purposes, had gone out of fashion, at least were greatly on the decline; for we cannot help looking with great suspicion on the charity which requires to have the bait of amusement and excitement thrown out to it. To make a trading speculation of what professes to be a work either of benevolence or public spirit, to resort to such a mode of raising funds as was adopted at Wisbeach, is, to say the least of it, in particularly bad taste, a succession of festivities and holiday rejoicings being altogether out of character with the actual occasion, which would have been more appropriately celebrated by a masque of the "Dance of Death," than by feasting and fireworks. Besides being altogether unsuitable in themselves, the "performances" got up for the occasion were upon a scale so wholly out of proportion to it, that it was an affair of a mountain bringing forth a mouse. Were the edifice that has been commenced at Wisbeach intended to be such a pile of Gothic architecture as Cologne cathedral, there would have been an excuse for the extraordinary rejoicings which attended the ceremony of laying the first stone; but as its internal dimensions will not exceed 30 feet by 16, somewhat less than those of a not particularly large dining-room, the fuss made by the good people of Wisbeach does partake somewhat of farce.

What was expended one way or other without any advantage all at to the funds for the building, must have amounted to a sum that would nearly have defrayed its total cost without further contributions. The fireworks alone, as we are informed by the *Cambridge Advertiser*, which has minutely chronicled all the "small beer" of this mighty affair, cost the "worthy vicar" not less than 40 pounds; and as the same gentleman kept open house during the week, with banquetting parties of "distinguished guests" to the number of sixty in one day, and a hundred-and-thirty another, he would hardly have been a loser, had he erected the chapel at his own sole expense, and thereby have secured to himself some more permanent fame than his "pyrotechnic treat" is likely to obtain for him. Perhaps this last, by the bye, was not altogether so inconsistent as it at first appears, for it may have been intended as a sort of *pyrotechnic sermon*, symbolizing the brevity of human life, the transitoriness of all worldly splendours, glaring for a brief moment in dazzling radiance, and then bursting and vanishing altogether into extinction and darkness; thereby serving as a most impressive memento-mori!

As mere amusements, those at Wisbeach were innocent enough in themselves, but were rendered unbecoming, by being altogether at variance with the occasion, which was made to serve as a pretext for them. They may also be taken as one strong manifestation of that strange spirit now rife in society, which seizes on every opportunity as one for indulging a passion for heated excitement and mountebank display, whether it be that of Father-Matthewism, or Puseyism, or Newmania, or any other mania of the day. Still, we certainly should not have bestowed any notice on the doings at Wisbeach, or at most should have pointed to them only as a caricature of the idle and nonsensical "ceremony of laying the first stone" of a building, as it is called, were it not that there is something else connected with the building itself of more immediate interest to our readers.

Notwithstanding that the chapel itself will be a mere miniature fabric, two gentlemen are employed upon it in the capacity of designer and architect—not a Wisbeach Pecksniff and Pinch, but persons of some note in the architectural world, viz. Professor Willis and Mr. Basevi, the first of whom has furnished the design, while the other merely acts as clerk of the works. Such application of the principle of division of labour and combination of talent, may in certain cases be proper and advantageous enough—for instance, in such an extensive and complicated pile as either Windsor Castle, or the "Palace of Westminster"; but in that of so very small a building there was no occasion for it—none at least for formally avowing it. The design being his, Professor Willis might have been allowed to pass as its architect, for it would have been taken for granted that he was not the operative one, but had professional assistance of some sort or other. As far, indeed, as he is concerned, the circumstance of another

name being mentioned, is not surprizing; but it is somewhat singular that the architect of the Fitzwilliam Museum should have consented—not to lend his name to the Professor, but to allow it to be formally made known that he acts in such subordinate capacity on so trifling an occasion. It certainly amounts to a formal acknowledgment on his part that there would be nothing objectionable in occasionally deviating from the present system, and applying to amateur architects for designs, and trusting to them for all matters of imagination and taste, a professional man being employed merely to execute the ideas of the other. That such course would be wholly preposterous and unwise, we do not say; on the contrary, we are of opinion that had there been some "Professor Willis" to many of our public buildings, they would have been far more satisfactory, in point of design, than they now are—perhaps the British Museum among others. It might, therefore, be not altogether amiss, were professional men occasionally to consult non-professional opinion and taste.

In the case of the Wisbeach Chapel, these are considerations which give it more importance than it might have else had in itself, because the course which has been adopted seems to emanate from the Camden Society, and the authority they assume and would fain establish for themselves in all matters of *Ecclesiology*—even to the extent of pedantical, busybody interference, and dictation. We may be mistaken, but it does look in some degree as if Mr. Basevi has lent himself, perhaps unsuspectingly, to the views of the Camdenists, in the hope of securing their patronage; and what he has done may now be set up as a precedent by which others are to be noosed. If the profession once allow that Society to get upon their shoulders, they will find them quite as difficult to shake off again, as Sindbad did the accursed old man who fastened himself upon his. In regard to encouraging greater attention to the proprieties of church architecture, the Camdenists may do some good, but they are by far too bigotted and intolerant—rigid precisians, denouncing without mercy whatever does not exactly square with their fanciful, yet starched and straight-laced code of ecclesiological statutes. They appear sadly averse to recognizing as lawful any other style or mode of treating it, than such as are by them privileged: every thing else they repudiate as partaking not only of architectural, but almost of religious heresy.

As to Professor Willis, he has distinguished himself as an able and intelligent architectural antiquary, notwithstanding that Mr. Gwilt has not thought his "Remarks on the architecture of the Middle Ages," worthy of being enumerated along with other publications of that class; but of the Professor's skill or taste in design we are unable to form an opinion, for the wood-cut of the Wisbeach Chapel, given in the *Cambridge Advertiser*, is so miserably drawn, that no reliance can be placed upon it. Making the utmost allowance, however, for that, the design itself looks very queer, and as if it greatly needed touching up by Mr. Basevi, unless together with bad drawing positive mistakes have been committed.

OBSERVATIONS ON ARCHITECTS AND ARCHITECTURE.

By Henry Fulton, M.D.

No. 1.

In the present era of improvement and invention, the science of architecture is least improved and least understood. I have conversed with many persons well conversant with all the other branches of art, who on the introduction of the subject, have met it with "Oh, I know nothing of architecture." I have met architects, who acknowledged they had no professional library; and I believe they felt this as no loss, for they seemed to consider any drawing tastefully got up, and calculated to catch the eye of their employers, quite good enough: in short, want of knowledge in the employer, begets carelessness in the employed. Feeling this strongly, I ventured in 1842 to deliver a public lecture [1] on the subject, to which the architects of Dublin were invited; but they met in conclave, and decided not to countenance the attempt of a mere amateur, or even to permit their pupils to attend, alleging that it was quite improper for a physician to attempt giving a lecture on architecture. The intention of delivering a course of lectures was announced. Why has it been given up? It was declared publicly that "the highest in rank in Italy were not ashamed of being professors of an art which Vitruvius taught and Palladio adorned." Are the architects of Dublin now ashamed of Vitruvius and Palladio?

Unless we look for something better than the works of either Palladio or Vitruvius, the science of architecture will profit but little; and as contrasted with the taste displayed in the Parthenon, the Pantheon of Agrippa, or the Minster at York, should only be considered as a mere trade in building, and not as one of the fine arts: and its professors, instead of ranking with painters and sculptors, should be classed with decorators and wax-work wig-block makers.

It is to be regretted that traces of this Palladio mania are to be found in too many of our edifices in London. If Palladio had not *adorned* his buildings with coupled columns, would we have had them in the exterior of St. Paul's? If Palladio had not placed portico over portico, would Sir C. Wren have left us—not us, but feathered bipeds—an aerial entrance facing Ludgate Hill? If Palladio had not misplaced pediments, calculated only for the terminus of a gable end, over his windows, would we have them, both acute and obtuse, stuck in every possible variety, over those of the banquetting hall, and five hundred other halls and houses in London? If Palladio had not revelled in rustic quoins and rustic fronts, would we have had these receptacles of dirt and dust meet our eye so often in our streets? If Palladio had not crowned his cornices with balustrades, would we have had these caricatures of columns entering into composition *called* Grecian? If Palladio had not broken up all his buildings and all his cornices, destroying all repose, all dignity, all simplicity, would our own buildings of the present day have presented us with so many examples of the want of dignity, unity, and simplicity? But we shall not swell this catalogue of Palladian beauties, but proceed to state the grounds of objection to them.

Corporal Trim's illustration of the disadvantage of placing too many sentinels on one post, may serve us as to the first, as no architect that loved his columns would crowd too many of them together; and further, no employer who loved his purse, would consent to it. One column, well proportioned to the superincumbent weight, is better than two slight ones, and two well proportioned columns are in excess, where one would suffice. It is true the ancients slightly contracted the distance between the columns at the angles of the buildings, but the coupled columns are a caricature of this, when the eye should have uniformity instead of variety.

Secondly, a portico should be an entrance to a building; and if so, how can the one pair portico of St. Paul's be so considered, unless for a set down from an aerial machine? but it will be time enough to provide for such contingencies when the plans for the machine itself shall be matured, and in the meantime, let us recollect the point of view in which columns should appear, and not violate good taste by placing them too high, either on stilts, or by making one row of columns and its architrave support another set and accessories.

Thirdly, a pediment is a true and legitimate termination, crowning the gable of a building in its entire extent; and according to the laws of fashion, a hat is a proper crown for a man's head: but it by no means follows that a hat is a suitable ornament (however diminished) for his shoulder, his eye-brow, or his upper lip: neither should the hat be of such dimensions as only to cover the centre third of the caput. But that great authority, Palladio, turned these window pediments to more account than his followers now do, for he placed a colossal figure in a half-sliding, half-reclining, though perilous posture, on each side, like two sentinels on one post. Improve on this, I beseech you, ye Palladians, and place one figure astride your door and window pediments, and turn them forthwith into hobby horses. If Mr. Barry had left out of the design for the Reform Club House those miserable window pediments and the rustic quoins, that building

[1] See lecture in *Journal*, Vol. V., p. 78.

would have added to his fame. If these pediments were to serve any useful purpose, they ought to have been placed over every window, and not those of the first floor alone; and if intended only for ornament, (?) all should have been thus ornamented. As representations of military cocked hats, they might have been selected by the more warlike clubs; but mere civilians have no right to such emblems.

Fourthly, besides rustic quoins and rustic fronts, we have the thing carried out still further; I do not know what name it rejoices in, but it may be seen on Burlington House and the Town Hall at Birmingham: this is intended, no doubt, to give us some idea of rocks. I do not know that Palladio is accountable for this latter; I rather believe it had its origin in the times of cutting yew trees into figures of things animate and inanimate. It may be very proper that a house should be built on a rock, but that a tree should represent a man, or a house a rock, is not so evident: the exterior of an edifice should represent one whole, not made up with a show of patches, but as a composition, stable and secure, concealing, not thus exposing, the smallness of the materials, by the introduction of rustic work, either as quoins or fronts. As receptacles of dirt and moisture, such work is unsuited to our climate, and can only be of use to the builder by swelling his bill of charges.

Fifthly, it is difficult to say why modern architects crown their cornices in almost every instance with balustrades. Surely the advocates of this practice do not think—if indeed they think at all about the matter, that a pigmy column can harmonize in a composition with columns of due proportion, or that a cornice is at all ornamented by this tasteless expenditure; but in truth the necessity for balusters, can only occur when the cornice itself is meagre, and does not sufficiently mask the roof.

Sixthly, broken lines and cornices are the most glaring faults of modern architecture. The only defence of the practice which I have heard given is, *that it relieves the eye!* Relieves the eye from what? The eye can take in a straight line easier than a broken one. When an officer wishes to show off his regiment to advantage, does he not dress his line? I wish our would-be Grecian architects would observe the same rule in dressing theirs. In order to observe the contrast between broken and unbroken lines, let us take a model of the Parthenon, and break up its cornices, &c., according to modern practice, and then look at the result. No—in the Greek style, and all those which attempt to approach it, simplicity must exist where dignity is desired, and this simplicity is not inconsistent with the highest state of finish, and with ornament, so rich, as to be beyond our ability to produce any thing similar, as for instance, the marbles of the Parthenon; but all ornaments should, as they did, harmonize with the edifice.

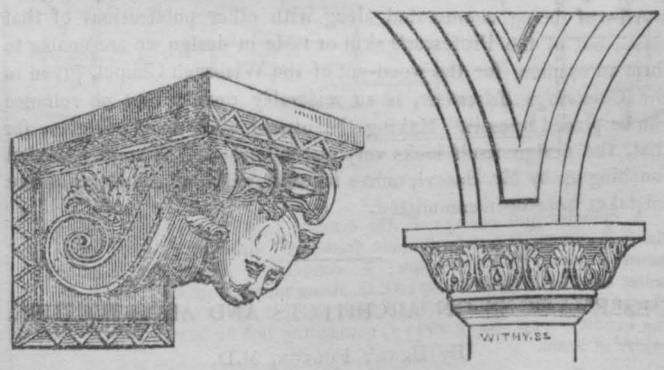
I believe I have seen all the urban edifices of Palladio; as to the suburban, I did not see many of them, nor did I think they were worth going out of the way to see, as I could not observe a single beauty in any of those I did see. Did Palladio draw on those works of the ancients, which he measured and delineated? Oh, yes, he did, just as Sir Fret'ul Plaigery, took the worst parts of the works of others; and yet these appropriations, when glaced beside his own productions, seemed like patches of silk embroidery on a fleecy-hosiery ground!

As in the lecture before referred to, most of the public buildings in Dublin are criticised (but not more severely than they deserve) I would wish to do justice to one erection made since the delivery of the lecture. And in truth, the breast wall carrying out the improvements in Nassau Street in that city, is every thing that could be desired, and although of humble pretensions, yet calculated to give more pleasure than a view of any of our ornate buildings. A plain straight breast wall (1300 feet in length) of well-tooled granite surmounted with a plain and suitable moulded coping on which the rail is placed. No breaks, no rustics, *nothing in the cant of false taste to relieve the eye:* no, the eye needs it not, for all is repose and harmony. I wish I could say as much of the railing, but perhaps it would be too much to expect perfection in it also, and as a contrast it is broken up by the heads of 48 trumpery pilasters, on which the arms of the College are introduced 94, and the name of the iron founder 47 times. From its locality we may say that this ostentatious display of the name of the *man of iron*, is the foundation of the bad taste of the superstructure. If the railing and the ornate stable at the east end of the screen corresponded with the chasteness and simplicity which characterise the breast wall, the entire might be hailed as the harbinger of improved taste.

Mr. Gwilt, who admires Palladio more than I do, will doubtless cry havoc, and let slip his pen against the attempt of a mere amateur to write on these subjects; but I am ready to stand up for my order, and ask who designed York, and the many other Gothic cathedrals of the same class and date? were *they* professional architects or mere amateurs? Was William of Wykeham an architect? and yet have professional architects since the age of the Parthenon and the Pantheon, produced any thing to equal them? St. Peter's itself, the pride and glory of modern Rome, is perhaps twice as large and cost ten times the amount required for York, and although, from its vastness, it is beautiful, yet it cannot stand a comparison with York or the Parthenon, or even the Pantheon of Agrippa.

But the amateur of the middle ages found the state of architecture degraded and debased; fortunately for posterity they knew nothing of Vitruvius, or of Grecian art as handed down by the Roman school, else, like Palladio, they might have attempted its restoration, and, like him, have failed. No! from the confusion into which the art had fallen after the age of Dioclesian, they did not attempt to rescue it, but out of this chaos created a new style, which, in after times, architects in derision called Gothic. Perhaps these amateurs may not have left us any thing equal, certainly nothing which surpasses, Grecian art, still they have undoubtedly left, at an immeasurable distance, all their revilers of the Palladio-Vitruvian school.

After the practice of the art had passed from Grecian into Roman hands, the decline was gradual but complete, and the age of Dioclesian exhibits its total decadence. That much, both of the Palladian or Vandal and Gothic architecture, arose out of the Dioclesian, is evident. In the ruins at Spalatro we have the swelled frieze, arches raised on slender columns, these latter supported by consols, which are ornamented with representations of the human face, just as we see in the Gothic, as the following, taken from Adam's work on Spalatro, plate xvi, will show.

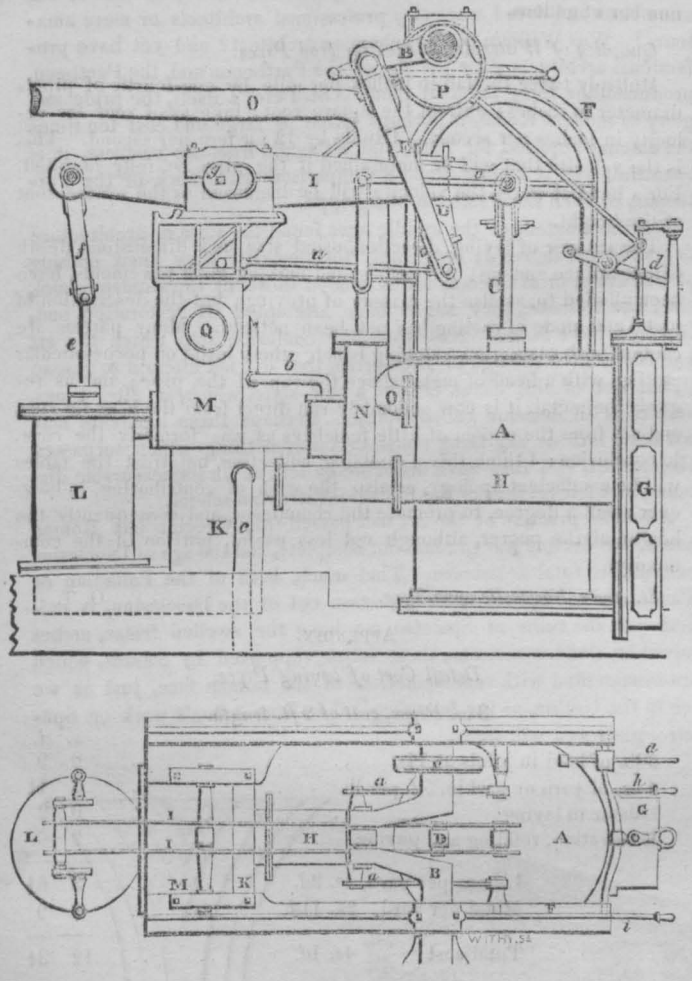


It is remarkable that the zig zag moulding on the consol is to be found on many of the early specimens of Gothic; and also, as pointed out to me by my friend Mr. Petre, on some of the Irish round towers. The moulding on the archivolt of the other figure will also suggest a strong resemblance to the deep doorways of the Gothic.

Let not the profession imagine that I want to transfer the working of the art from their hands into that of amateurs. Architecture is a profession the details of which require much experience and study, and few amateurs will be found capable of working out these details; but the same judgment which is necessary to enable a purchaser to feel the merits of a painting or a statue, is absolutely necessary in the science of architecture; and unless that taste exist, it is in vain to expect any thing like improvement in the designs for either our

public or private edifices. But it is to amateurs, and not to the profession, that a more correct taste is to be looked for, and although almost every one feels the defects of what has been done in our times yet until men of intellect and mind (amateurs though they be) shall seriously turn their attention to the subject, it is in vain to expect any improvement.

MARINE DIRECT ACTION ENGINES OF THE "LORD YARBOROUGH."



A, cylinder and casing; B, the cranks; C, piston rod; D, hanging link; E, connecting rod; F, main frame; G, slide valve case; H, exhaustion pipe; I, main beam; K, condenser; L, air pump; M, hot water cistern; N, feed pump; O, O, steam pipes; P, eccentric; Q, discharge pipe; *a*, *a*, radius rods; *b*, feed pipe; *c*, injection pipe; *d*, starting handle; *e*, air pump rod; *f*, connecting link to beam; *g*, roller to centre of beam.

Wishing to make this *Journal* a chronicle of present improvements in marine engineering as well as a record of the past, we this month publish a descriptive account of a pair of "direct action" engines, manufactured as far back as 1825, and erected in a vessel called the *Lord Yarborough*, and now, and from that date, plying between Portsmouth and the Isle of Wight, working in a very satisfactory manner.

The designer, and we may say, constructor, of these engines, is Mr. William Yates, then of the Commercial Road, but now having charge of the steam machinery at Messrs. Currie's distillery at Bromley, near London; and taking into consideration the date of their introduction, will be found to contain considerable merit.

In the discussion, in this *Journal*, on beam and direct action engines, the existence of the *Yarborough's* engines does not appear to have been known, otherwise their similarity with the *Gorgon* engines no doubt would have been noticed.

In 1821, a caveat was lodged by Mr. Yates, and a patent would have been obtained for this construction of engine, but for various reasons, that it is unnecessary to enter upon here. It appears that in 1825 the Portsmouth and Ryde Steam Packet Company gave Mr. Yates an order for a pair of these engines of 18 H.P., and they were made as represented in the annexed engraving. The cylinders are 24 in. diameter and 2 ft. 8 in. stroke, the radius of the crank equalling 12½ in. The power, at 175 ft. per minute, equals 16¾ H.P. each cylinder. Paddle wheels 11 ft. diameter, and length of paddle equalling 5 ft. Beam of vessel 13 ft.; draft of water 5 ft. 9 in.; immersed section equals 33 ft.

This kind of engine certainly possesses many advantages; among others may be mentioned, small space occupied, light construction, and principally, their position in the vessel, near to the centre transversely, and bearing chiefly on the kelson or strongest part of the ship, the most important part of the machinery being below the water line, all which points were duly considered by Mr. Yates 22 years since.

Mr. Yates also furnished drawings of a *three cylinder* engine, designed in 1821, at the request of Captain Borne, of the *London Engineer* steam vessel, to increase her power from 70 H.P. to 105 H.P., without requiring additional space, but it was rejected on account of the shortness of the connecting rod; this arrangement might be applied to large powers with great effect. On the whole, we cannot but highly applaud Mr. Yates for his ingenuity, and see that the opinions and views he entertained 20 years since, have been lately adopted by others.

ON STREET MAINS OF CAST IRON, FOR GAS AND WATER CONVEYANCE.

The present unprecedented low price of iron offers an opportunity for the extension of gas and water works, which it is surprising has not been urged with avidity by such places as are yet destitute of the luxury of either; and at the same time, considering that the furthering of such works is one of the occupations of the civil engineer, I am induced to send you a paper on the subject of street mains, being the collection and collation of examples which have fallen under my notice during an attention of upwards of one third of the useful portion of human life. First as to the direction of the pipes or mains. They should be laid in as straight a course as possible, and their inclination should be uniform and not to exceed one in a hundred, if it could be avoided by any possibility; and where descending mains meet and form an angle, syphon pipes or receivers should be placed to collect deposition of mud, &c. The names main and sub-main are given to leading pipes from 4 in. to 18 in. diameter, and for smaller, the term service pipes is used. Pipes are of two descriptions, socket and flanched, a table of each description is given; in measuring socket pipes, the socket is excluded from the measurement. Pipes above 4 in. are all cast 9 ft. long, and under 4 in. down to 1½ in. are usually 6 ft. long, and 1½ in. are 4½ ft. long. The pipes are generally delivered at the works, and then previously to being used, are proved by hydraulic pressure equal to a column of water 250 ft. high; and in warm weather it is desirable in proving pipes to use warm water. Practice will enable a skilful prover to tell by the ring of a pipe, from a tap with a hammer, whether it is faulty, either from being cracked, or deficiency in thickness. It is usual for pipes all above, say, 4 in., to be charged by the ton, and for the smaller, a certain price per yard, varying as the size, the socket being excluded from the measure; the price for straight pipes in 1834, was 150*s.* per ton, the bends and branches, or particular pipes, being 40*s.* additional, and the boring of the fire plugs also being extra, at, say, 18*d.* each. In 1832, from the same note book, I find the cost of straight pipes was 138*s.*

per ton, the difference of 12*s.* per ton being altogether due from the facility of delivery; about the same time also, I have the price per ton 135*s.*, and the extra for particular pipes, 55*s.* With respect to the cost of digging trenches, they will vary as the depth; and I know they have been done as follows, 3 ft., 4 ft., and 5 ft. respectively, 2½*d.*, 3½*d.*, and 4½*d.* per lineal yard; also, in regard to paving, ramming, and removing surplus earth; and finding stone where deficient, the price will vary with the nature of the material, as Macadamised road, square paving, and random paving, which I have done at per lineal yard, as follows, 3*d.*, 5½*d.*, and 7½*d.* The depth below the surface of the ground should not be less than 18 inches, to guard against frost and casual disturbance of the street by repair. The contractor for the work or pipe-layer generally finds his own tools and lights, the company being at the expense of repairing damage to lead pipes, repair of roads, and removal of rubbish. I should rather say that four contracts are usual, one for the pipes per ton delivered, another for the pavement, a third for the trenches, and fourth for pipe-laying. Joints of the pipes are usually made with molten lead; but other materials are also used for economy, viz., wooden wedges, (see *Journal*, Vol. I, p. 242.) also wood with iron wedges interspersed; a mixture of cast iron borings with sal-ammoniac is sometimes used for socket pipes. For flanched pipes a wease or washer of yarn or sheet lead, smeared with red or white lead, is used, and the pipes being cast with a flanch at each end and screw bolts inserted, and when screwed tight the joint is complete.

In the appendix I have given a table showing the weight of flanched pipes, and the number of holes in the flanch. In the second table is the weight and thickness of socket pipes with the cost of the pipes per yard delivered, and the total cost per yard including pipes and laying, and in the third is a table of detail for 3, 4, 5, 6, and 15 inch pipes, from actual execution, and from which the cost of the pipes in the 2nd table has been computed. It must be borne in mind, that the weight of pipes is also applicable to columns or pillars. In that very useful work *Laxton's Builders' Price Book* several tables are given of pipes, and one in particular gives the usual lengths and different diameters and weights of lead service pipes.

It has been previously noticed that the boring of fire plugs and particular pipes are charged extra, but the most costly appendages yet remain to be noticed, viz., slide cocks with brass and copper facings, which will cost 21*s.* per inch of the pipe's diameter for all sizes of pipe, and for the smaller size as high as 35*s.* per inch. The when, why, and wherefore, of the introduction of these, as also the size of the mains and their gradual diminution to suit particular localities, must be left to the hydraulic engineer, but, as a general question, I may be allowed to state from 14 in. to 15 in. diameter of pipe will be sufficient to supply a population of from 70 to 100,000.

The subject of the flow of water through pipes of different lengths, both horizontal and vertical, has occupied a good deal of your pages, and a paper was read to the Institute of Civil Engineers by W. A. Provis, Esq., in the session of 1838, and reported in the *Journal*, Vol. I., p. 383, containing the following deductions. "In level pipes the quantity of water discharged is nearly in the inverse ratio of the square root of the length; but the departure from this rule is greatest in the shortest lengths and greatest heads. In inclined pipes, the increased discharge is greater in the long than in the short pipes. The increased discharge for an increased head is nearly in the same proportion through the long and short lengths." The above extract is the result of several experiments forming a direct appeal to nature for facts. At page 407, vol. 5, of the Journal, commences your review of Mr. Shuttleworth's Patent Hydraulic Railway, which has led to your pages being so fully occupied, perhaps unprofitably, with the subject of the flow of water down vertical pipes, which has also been continued by yourself, and a correspondent T. F—N, in Vol. 6, pages 37, 123, and page 149, by I. T—N, which as connected with this subject, I have noted for future reference. The following rules as to the quantity and velocity of issuing water, I have collected from various sources; the first was given me by a friend who is an hydraulic engineer, viz. formula for calculating the quantity and velocity of issuing water. Let h be the head of water in feet, d, diameter in inches, l, length of pipe in feet:

$$15\sqrt{\frac{h\,d}{l+5\,d}} = \text{velocity};$$

$$30\,d^2\sqrt{\frac{h\,d}{l+5\,d}} = \text{gallons discharged per minute.}$$

To find the weight and quantity of water in full pipes, square the diameter in inches, which will give the weight in pounds in a yard of pipe; and if one figure be cut off on the right hand, it will give the number of gallons.

Quantity of Water discharged by Iron Pipes.

Multiply twice the fall in inches per mile by one-fourth of pipe's diameter in inches; extract the square root; take $\frac{10}{11}$ of root for velocity in inches per second. Divide by 12 for feet per second. This is the velocity that will be maintained if the pipe be fully supplied. For a head of water the velocity will be increased as the square root of the height.

The manner of laying, direction, usual size and dimensions, depth below surface and cost of trenches, and making good pavements, have been alluded to, as also the manner of proving; but the description of metal and mode of casting has not been noticed. Many parties are content with casting on a sloping bench, others insist on perpendicular casting, with a head of metal above the top of the pipe; and as regards the metal, it is now commonly run direct from the blast furnace, and not from the cupola of little foundries as was formerly the case. In conclusion: I think this a rambling collection, but trust the tables will be a sufficient apology, as also the wish of contributing, in however small a degree, to promote the cleanliness, and consequently the health, of the poorer, although not less useful, portion of the community.

St. Ann's, Newcastle-upon-Tyne. O. T.

APPENDIX.

Detail Cost of laying Pipes.

3 in. Pipes, cost of 9 ft. length.

	s.	*d.*
6 lb. of lead in joints at 14*s.*	0	9
4 oz. of yarn or gaskin, 5*d.* per lb.	0	1¼
Labour in laying	0	2
Excavation, refilling and paving	2	6
Labour per yard, 1*s.* 2*d.*	3	6¼
Metal per yard, 2*s.* 11*d.*	8	9
Total cost 4*s.* 1*d.*	12	3¼

4 in. Pipes.

8 lb. of lead in joints, at 14*s.*	1	0
5 oz. of yarn	0	1½
Labour in laying	0	2½
Excavation, filling and paving	2	6
Labour per yard, 1*s.* 3½*d.*	3	10
Metal ditto 4*s.* 1*d.*	12	3
Total cost 5*s.* 4½*d.*	16	1

5 in. Pipes.

10 lb. of lead in joints, at 14*s.*	1	3
6 oz. of yarn	0	2
Labour in laying	0	3
Excavation, filling and paving	2	6
Labour per yard, 1*s.* 4½*d.*	4	2
Metal per yard, 5*s.* 9*d.* .. .	17	3
Total cost per yard, 7*s.* 1½*d.*	21	5

6 in. Pipes.

12 lb. of lead in joints, at 1*s.* 2*d.*	1	6	
½ lb. of yarn	0	2½	
1 yarner, 1 clayer and rammer, 1 pelter up, 3*s.* 6*d.* each, two labourers, 2*s.* 6*d.*, 1 fireboy to 55 joints ..	0	3¾	
Excavation per length	1	0	
Filling and Paving ditto	1	6	
Labour per yard, 1*s.* 6*d.*	4	6¼	
Metal per yard, 6*s.* 9*d.*	20	3	
Total cost per yard, 8*s.* 3*d.*	24	9¼	

15 in. Pipes.

32 lb. of lead	3	10	
Excavation per length	1	10½	
Filling and paving ditto	2	9	
2 lb. of gaskin	0	10	
Labour per yard, 3*s.* 8*d.*	1	9	
	11	0½	
Metal per yard, 24*s.* 2*d.*	3	12	5½
Total cost per yard, 27*s.* 10*d.*	4	3	6

TABLE OF WEIGHT AND DIMENSIONS OF FLANCHED PIPES.

Diameter of Bore.	Thickness.	Diameter of Flanch.	Number of Bolt Holes.	Size of Holes.	Diameter of Circle thro' Holes.	Thickness of Flanch.	Weight of a 9 ft. Length.		
							cwt.	qr.	lb.
2		6½	4		4¾	9/16	0	3	0
3		7½	4		6		1	0	3
4		9¼	4		7¾		1	3	5
5		10½	4		8¾		2	1	12
6		12	4	⅞	10	⅞	3	2	1
7		14	6	⅞	11¾	1	4	3	17
8		15	6	1	12¾	1	5	2	9
9		16½	6	1	14¼	1 1/16	6	1	12
10		17½	6	1	15½	1⅛	7	0	0
11		19	6	1	16¾	1 1/16	8	3	24
12		20	6	1⅛	17¾	1¼	9	3	5
13		21	6	1⅛	18¾	1¼	10	2	0
14		22	8	1⅛	19¾	1¼	11	0	26
15		23	8	1⅛	20¾	1¼	12	0	25
16		24½	8	1¼	22	1 5/16	12	3	8
17		25½	8	1¼	23	1 5/16	13	2	17
18	1	26½	8	1¼	24	1⅜	16	1	15
19	1	28	8	1⅜	25	1⅜	17	2	13
20	1	29	8	1⅜	26	1⅜	18	0	26
24	1	33	10	1⅜	30	1⅜			

Cost of laying pipes, including digging, filling in, and lead for joints, but exclusive of pipes and carting superfluous earth, and making good roads, *per yard.*

Inch.	*s.*	*d.*	Inch.	*s.*	*d.*
2	1	0	8	2	0
2½	1	1	9	2	6
3	1	2	10	3	0
4	1	3	12	3	6
5	1	4½	15	4	0
6	1	6	18	5	0
7	1	9	24	7	0

	s.	*d.*
Relaying, paving, or making good roads, *per yard*	0	9
Boxes for plugs, *each*	2	0
Ditto with flaps, *each*	3	0
Spiggots, *each*	0	6
Boring Plugs, *each*	1	0

ELECTRO-GALVANIC BLASTING.

SIR—Having read with much interest, in your *Journal* for August, the account of the various applications of the electric fluid to the useful arts, by Mr. Alexander Bain, I beg to communicate to you another application of the conducting power of water, which, with the approval of Major-General Pasley, I have lately adopted in firing sub-marine charges over the wreck of the "Royal George," at Spithead, and which the General and myself both consider a great improvement on the mode hitherto practised.

My attention had been for some time led to this subject, in carrying on some experiments in June and July last, on the relative power of different lengths of wire conductors in use over the wreck, for transmitting the electric fluid. These conductors consist of two stout copper wires, separated by an 1½ inch rope; the wires are carefully insulated and paid over with tape, yarn, and waterproof composition: the rope is saturated with the same composition, being immersed in it while boiling, and yarn is then bound round the whole with a second coat of the composition over it.

The apparatus used for the experiments was the voltameter, consisting of a glass vessel with inverted tubes, two pieces of platinum wire were fixed into the sides of the vessel, and bent at right angles, to enter the tubes; on connecting the two ends of the conducting wires at one extremity, placing a voltaic battery at the other, and the voltameter within the circuit, the water in it was rapidly decomposed, gas was emitted and passed into the tubes, which being graduated with a scale divided to tenths of inches, showed the relative power of each length of the wire conductors by the quantity of gas delivered in a certain time.

I was, however, surprised to find that decomposition of water ensued, even when the ends of the wires furthest from the battery were disconnected, and it soon became evident, that as these wires had been frequently used for firing charges at a depth of 13 fathoms under water, a certain degree of moisture must have been forced in by the great pressure at that depth through the exterior coating, notwithstanding the precautions used to make it and the wires waterproof, and thus the electric fluid must have been led from one wire to the other, causing action in the voltameter; this became still more apparent on applying the voltameter and battery to a length of wire conductor which had never been under water, as unless the ends of the wires were connected, there was no gas emitted. There was another convincing proof of the power of water as a conductor, though it in some measure frustrated the object of my first experiments; but prosecuting the subject still further, I have since been enabled to turn this power to account, by using the water as a conductor in conjunction with a single wire for firing charges, which are daily required over the wreck.

The method of doing this will now be stated.

From Mr. Bain's experiments as well as my own, it appeared that using water as a conductor in conjunction with a single wire, a certain metallic surface must be present at each extremity of the wire, to ensure the transmission of a sufficiently powerful current of electricity. In the case of sub-marine explosions, it would therefore be necessary to have one surface of metal at the bottom of the sea, and another at the top, the depth of water forming the conductor between them, and as the greater part of the charges used at Spithead are common oil cans of tin, (a good conducting metal,) varying from two to five gallons, it occurred to me to make use of the tin can as the metal required at the bottom, and at the surface of the water to use plates of zinc.

Before lowering the charge to the bottom, the single wire is connected to one of the priming or short wires inserted in the bursting tube of the charge, and the other priming wire is turned down on the tin and connected with it. The charge is taken down by a diver, who places it, and after he has come up, the zinc plates are immersed, (I found by experiment, that three plates of 10 in. by 7 in. were required) connected by copper wire passed through a hole in the top of

each.) The end of the single wire above water, and that of the short length attached to the zinc plates, are led to a battery, which for firing charges in 13 fathoms water, should have a power equivalent to 6 cylinders of Daniell's battery; this I found to be the minimum: on completing the circuit, the charge is fired by the transmission of the electic fluid down the single wire, igniting the piece of fine platinum fixed across the priming wires within the bursting powder, and returning by the water, which over the wreck of the "Royal George," completes a portion of the circuit equalling 80 feet.

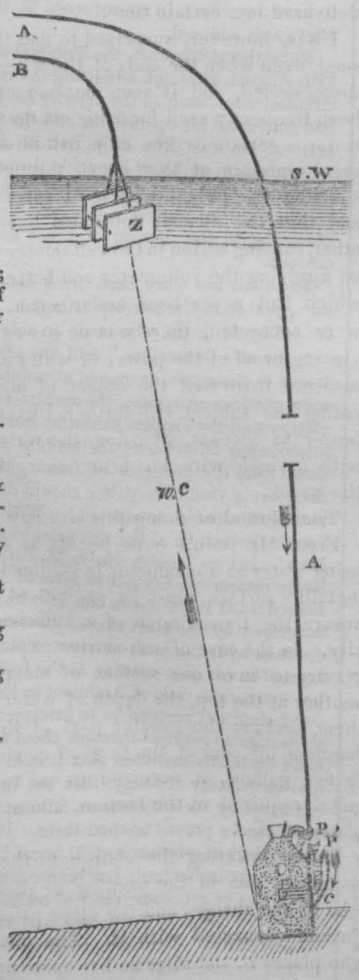
This method has now been so frequently tried and without a single failure, that it may be considered as certain and secure, and I consider it superior to that of the double wires, on account of the greater liability of the latter to break, or to be brought improperly in contact, by the shrinking and contraction of the rope after imbibing moisture; the saving of wire, is also a great object, and the single wire may be conveniently coiled on a common log reel, and held in the hand while being passed over the side of a vessel when used on a wreck.

This system may be used for charges contained in vessels of tin, iron, copper, or any other conducting metal; but when wooden casks are used, it will be necessary to attach a certain surface of metal to the cask.

I annex a sketch of the mode of connecting the single wire with the priming wires, &c.

I remain, Sir,
Your very obedient servant,
G. R. HUTCHINSON,
Lieutenant Royal Engineers.

Portsmouth, 10th September, 1843.



REFERENCE.

A & B, two single insulated wires; the ends are led to the poles of a voltaic battery in a boat or lighter.
C, 3 zinc plates, 10 in. by 7 in.

A, a single insulated wire conducter.
B, a single wire.
The ends of the two wires, A & B are led to the poles of a voltaic battery in a boat or lighter.
Z, 3 zinc plates, each 10 in. by 7 in.
C, 5 gallon tin can, holding about 51 lb. of powder.
P P′, priming wires of bursting charge.
c, point of contact of priming wire P′ with surface of tin can.
w c, water conducter, 80 feet.
S. W. surface of water, 13½ fathoms above the bottom.

MUSEUM OF THE HERMITAGE, ST. PETERSBURG.

ON it being first of all rumoured that Klenze had been commissioned by the Emperor Nicholas to prepare designs for a Museum at St. Petersburg, the natural supposition was, that the building was to be an entirely new and distinct one, as was the case with the Glyptothek, and the Pinakothek at Munich, the reputation of which most probably led to the architect's being employed by the Russian sovereign. It now turns out, however, that the structure will not add to the number of the architectural monuments of St. Petersburg, as it is only a rebuilding and extension of the Hermitage Palace, in which the "Raffaelle Gallery," so called from its being a fac-simile imitation of the Loggie of the Vatican, is retained. Still, if description may be trusted, it is very greatly superior to what has been removed to make way for it; and though only an appendage to the Imperial Palace, it is in itself much larger than many palaces, the general plan forming a parallelogram of 520 by 380 ft., English measure, which is not very far short of the area of the whole of the quadrangle and buildings of the upper ward of Windsor Castle. The largest of the inner courts is 215 by 130 feet; the general height of the façade 74 ft., and that of the pavilions at the angles, 106 ft. In regard to the character of its details, the style of design is Greek, and it would seem the design itself is in some respects similar to the architect's idea for the Pantechnikon, at Athens, published in his "Entwürfe." Of the actual composition, however, it is impossible to speak from the verbal description given of it; for let the last be ever so correct as far as it goes, so many circumstances indispensably requisite to be understood, are passed over in it, that it is more tantalizing than satisfactory, leaving altogether doubtful some very material points. The *socle*, which is of reddish granite, is 11 feet high, and must therefore be of colossal proportions, and produce a most imposing effect, if it be really what the term applied to it imports—a solid substructure, in appearance at least, without windows of any sort. Nothing being said to the contrary, we are left to suppose that such is really the case; but it would have been far more satisfactory to have been distinctly assured of it, since it makes a most prodigious difference indeed whether it be so or not. Colossal must also be the effect of a mass, nearly the entire height of the Reform Club House, but with only two ranges of windows, reared on such a basement. This part of the structure is of greyish stone, with some intermixture of reddish granite for the details, yet to what extent the latter is applied is not said; hardly at all, we should think, can it have been employed for any of the more delicate and enriched parts, and enrichment does not appear to have been at all spared, for we are told of arabesque panels, sculptured friezes, statues, some supported on consoles, others within niches, hermes-pillars, &c. &c. In short, the description makes magnificent promise to the ear; but whether the structure itself would keep such promise to the eye, is what we will not pledge for. Description is equally favourable to the interior, but equally perplexing also, being by far too indefinite; a vast deal of magnificence is spoken of—variegated marble columns, inlaid pavements of Grecian design, and other matters of that kind, but it is all shapeless. Almost the only part which we can figure to ourselves at all intelligibly is the grand staircase, 130 ft. long, by 50 in breadth, with its twenty marble Corinthian columns, and three successive flights of marble steps (22 feet wide), ascending in a direct line. At any rate, in such a staircase there must be an air of extraordinary pomp. The rooms on the lower floor are intended for the reception of sculpture, vases, and miscellaneous antiquities; those above for a picture-gallery, distributed into a series of rooms, some very spacious, and lighted from above, as in the Munich Pinakothek, for larger pictures; others as cabinets, for smaller pictures, besides various loggies and corridors. The contents of the museum will be so arranged, that the apartments will have more the air of being decorated with them, as in a private palace, than of being the exhibition-rooms of a public museum, which sometimes give the idea of a bazaar, at others, of a charnel-house of art, stored with works, immortal, perhaps, in fame, but perishable, and even perished; interesting, but utterly illegible inscriptions, limbless statues, featureless busts, and pictures touched and retouched by time, till they have become only so many grim blackened canvasses, and melancholy *memento-mori's*. Although the building was not begun until the spring of 1842, the Museum of the Hermitage is expected to be completed by the end of the present summer, notwithstanding its great extent and the prodigious solidity of its constructions. In some places such an edifice would have been the work of a quarter of a century.—*Art Union.*

FALL OF THE BELFRY OF VALENCIENNES AND TRIAL OF THE ARCHITECT.

STRANGE as this latter may sound in the ears of an English architect, it is not less strange than true, that trials of professional men in France for homicide, produced by negligence or ignorance, are by no means of rare occurrence. It will be remembered that on occasion of the accident and great loss of life some time since on the Versailles Railway, an engineer and, if we mistake not, several other persons were placed upon their trial and found guilty of homicide.

In the case which follows, the architect charged with the repairs of the tower, was adjudged guilty by the local tribunal, and with a strange mockery of justice, was condemned to expiate the crime of homicide, by paying the trifling fine of 100 francs. The *Cour Royale*, however, before which the cause was afterwards tried on appeal, reversed this decision and acquitted the architect. The following particulars respecting the destruction of the tower and the subsequent trials have been gleaned from the *Gazette des Tribunaux*; and although the description of the building itself is very meagre, yet the account will show to our readers the kind of responsibility which attaches to professional men in France for the failure of their works. It is probable that in point of law the circumstances under which an architect becomes responsible, as described by the prisoner's own advocate, will equally apply in this country.

Most cities in the north of France possess those ancient towers called *belfries*, which are monuments raised in the 12th and 13th centuries, since which time they have stood, like huge sentries, watching over the public safety and the liberty of the inhabitants. In 1237 the generosity of Jane of Flanders endowed the city of Valenciennes with land for the site of a belfry, and in the interval from 1250 to 1260 the edifice was completed. Had this belfry of Queen Jane been more respected by man than by the hand of time, it might still have been standing. Such was not to be its fate, however; for in 1782, under the provostship of M. de Pujol, it was subjected to the unhappy devices of some architect, who imposed upon the old tower a roof of a new construction, formed by a kind of *petit dome*, ornamented with vases in the true Pompadour style, presenting a most ridiculous contrast to the severe architecture of the middle ages; but not content with this profanation, the architect erected on the top of the tower 26 enormous stone consoles, weighing nearly a million and a half of pounds, which immense weight so deranged the stability of the structure as to throw it out of the plumb line, and open fissures between the courses of stones large enough to admit the penetration of water. Thus the old belfry, which had gloriously withstood the cannon balls of 1793 and 1815, was found in 1837 to be labouring under serious infirmities.

At this time the Sieur Pétiau, who had recently quitted the School of Fine Arts at Paris, where he had acquired the most honourable distinctions, was recalled into the arrondissement which had given him birth, in the capacity of architect to the city of Valenciennes.

The dilapidated state of the old belfry, its rents and crevices, the shattered buttresses and loose stones, which occasionally threatened the destruction of passers by, could not escape his attention. In special reports of the 22nd July, 1837, and 3rd February, 1838, he pointed out the urgent necessity for reparation, and proposed at the same time a plan for extending the base of the edifice upon the rock which served for its foundation, for encasing parts of the old and decayed masonry, and for tying the whole together in a strong and substantial manner.

This plan was not acted upon by the municipal council. Another architect was consulted, who merely advised the underpinning and reparation of the counterforts. M. Visconti, an eminent architect from the capital, expressed himself in 1841 to the same effect. A design for effecting this work was then required from the architect Pétiau, who accordingly transmitted one to the committee of the municipal council. This design, after a delay of 4 years, was at length decided upon, and received the approval of the commission of buildings for the department of the north.

The works of repair were commenced in October 1842, and were vigorously prosecuted till January 1843. The inclemency of the season then caused a suspension till the beginning of March, and in April, soon after their recommencement, one of the counterforts was observed to be rent by a large crevice. The tie-bars, to which the architect resorted, could not stop the progress of this crevice, the falling of stones continued to increase, and by the 6th of April a general alarm had spread through the city. The architect Pétiau had still faith in the solidity of the mass, and in this he was confirmed by the opinion of the Parisian architect, who had reported in 1841, "that there was nothing alarming in the state of the structure." The mayor personally visited the tower on the 6th of April, and requested the architect to furnish him with a report in writing, which was remitted to him in the evening of the same day.

In this report the architect pointed out the various accidents which had occurred since the commencement of the works, and in reference to the danger of passing in the neighbourhood of the town, expresses himself in the following terms: "all human prudence cannot prevent occasional masses, of various sizes and in various stages of decay, from detaching themselves and bringing down in their fall sounder parts of the masonry, to the serious risk of the public safety. I think, then, that every precaution should be taken by the administration to avert the danger. At the same time, although accidents are to be feared from the fall of loose stones, I firmly believe that the mass is solid, and that there is more danger in the counterforts than in the walls."

Throughout the 7th of April the symptoms increased, and during nine successive hours M. Pétiau was personally engaged in superintending the works and in hastening the evacuation of the neighbouring houses. At a quarter before 4 o'clock he was still within the tower, examining all the symptoms of ruin which it presented, and was not able up to that time to detect any immediate danger. Scarcely, however, had he quitted the place, when several loud cracks were heard, and the whole tower fell bodily over, while a huge cloud of dust expanded in every direction, giving to view, as it slowly cleared away, a scene of destruction impossible to describe. The once lofty tower was now reduced to a stunted irregular pile, varying from 3 to 10 feet in height. Many of the neighbouring houses were seriously injured by the fall, and several dead and wounded victims were buried beneath a mountain of ruins. One unfortunate man was precipitated from the top of the tower, which was 240 feet in height; several persons who were passing were also killed, as well as some who were left in the adjoining houses.

This frightful catastrophe, the occasion of so much misery, both public and domestic, could not escape the notice of justice, and accordingly the *procureur general* was speedily on the spot. An inquiry was instituted, and the architect who had been directing the work became the subject of judicial proceedings. A commission of architects appointed to examine into the occurrence, pointed out several particulars in which the city architect had acted on his own responsibility, and enumerated various precautions which he should have taken. The greater part of these criticisms, however, failed to have any effect, in consequence of the contradictory evidence which was afterwards adduced.

Notwithstanding this, the Tribunal of Valenciennes, in its judgment of the 12th August, although admitting in favour of the accused several extenuating circumstances, such as the activity he had displayed, the care with which he had conducted his operations, and the inspection which he had made at the peril of his own life, only half an hour before the fatal occurrence, yet adjudged him guilty of homicide through imprudence, and condemned him to pay a fine of 100 francs. They imputed to him the fault of not having sufficiently announced the dangerous state of the entire structure, although according to the opinion of other architects, this danger was sufficiently obvious.

The affair has since been tried before the *Cour Royale*, in consequence of an appeal from the inferior tribunal. On this occasion the accused was defended by M. Huré, who made an able speech in his behalf.

"The arts themselves," said the advocate, "bring at one time great rewards to their professors and at another great punishments. At the end of some perilous enterprise, the architect has sometimes to boast of the palm of victory and the chaplet woven by honourable success; while not unfrequently an unhappy failure overwhelms him with shame, and hurls him mercilessly down from the precipice of fame. Mark with what sobriety and caution, therefore a vindictive public should descend into the arena where the champion lies already conquered! With what timidity should justice herself invade the temple of the fine arts, to slay over again the already vanquished hero! Let us inquire who is M. Petiau, the person here accused. He has lately returned to his native city of Valenciennes, from the School of the Fine Arts at Paris—he is one in whom the most brilliant talents have been developed by the most skilful masters, and who, decorated in five successive contests with the most eminent distinctions, has at length returned to fix himself in his own country at the foot of this fatal tower, with the modest but honourable title of Architect to the town.

"I shall not pretend so to interpret the ancient usages and laws upon this subject as to contend through them for the irresponsibility of the accused, but I do boldly maintain that it is in architecture as in medicine, in surgery, and in military strategy, that the innocence or guilt of men is not to be measured by their success or failure, but by the degree in which palpable error can be proved against them. Before an unfortunate artist can be made the subject of punishment, it must be established upon clear evidence that some inexcusable fault has been committed, some gross offence against the principles of art, some error of omission or commission so obvious as to fall under the notice of the senses, and then, when this has been clearly proved by correlation of cause and effect, to have led to the accident in question, it is time to condemn."

Proceeding, then, to the special circumstances of the case, the advocate shows that M. Pétiau is not even the author of the project of reparation

which has thus signally failed. That the project, on the contrary, was conceived by other architects, was adopted by the municipal council on the report of its own commission, was afterwards sanctioned by the council of buildings for the department of the north; and as for M. Pétiau, it was only after having unsuccessfully contended against this project for four years, that he at length consented, with equal modesty and resignation, to lend his exertions towards its execution. "When these exertions have proved unsuccessful, is it right that the punishment of failure should be visited upon his head alone?

"The prisoner is accused of not having foreseen immediate danger to the whole mass from the great rent which took place on the 3rd of April, but have you not heard, on the testimony of a municipal councillor, that similar rents had existed in the tower for the last forty years? Figure to yourselves a doctor of medicine placed at this bar on the charge of having promised life and recovery to a patient whom it had pleased Heaven to remove the very next day; and then mark this difference, that the doctor has the advantage of receiving responses from the patient himself as to his most inward feelings and the symptoms which might indicate an approaching dissolution. But on the other hand, this massive and impenetrable tower was silent to all inquiries, and gave forth no sound in answer to the voice which might demand the inward symptoms which preceded its sudden destruction.....

"The architect, then, is irreproachable in every point of view. Let justice address herself to others, if a victim be indeed necessary. But in my opinion, the individual is not to be found upon whom the punishment of offended law can with justice be visited. The fall of the old tower was one of those misfortunes which Providence, alas, too frequently suffers to fall upon poor humanity. These are the consolations which remain for the able though unfortunate architect. Pardon, then, in the name of justice! pardon, for the sake of the academic laurel which yet crowns his youthful brow."

This able address was followed by an honourable acquittal of the architect, and the court, reversing the judgment of the inferior tribunal, ordered him to be set at liberty without costs.

STYLES AND METHODS OF PAINTING SUITED TO DECORATION OF PUBLIC BUILDINGS.[1]

By C. L. EASTLAKE, Esq. R.A.

THE numerous public edifices which have of late been completed in France and Germany have, in almost every case, been embellished with the productions of painting and sculpture. This application of the imitative arts has prompted inquiries into the principles which may regulate the adaptation of those arts, and especially of historical painting, to architecture; not without reference to the examples of success and failure which the decorated buildings of former ages present. The same question which is now proposed for solution in this country, in the intended decoration of the Palace at Westminster, has been considered and practically answered with various success in Munich and in Paris. The experiments that have been made in those cities by artists of eminence and the opinions that have been expressed thereupon by competent judges, form, therefore, an important addition to the evidence of older works of art, and may assist in the examination of the subject.

The union of painting with architecture supposes a principle of adaptation or selection, in the style of one or both. The architect, in arranging his spaces, might find it advisable to adapt their size to the distance to which the spectator could conveniently retire to contemplate the paintings; or might be induced to vary the form of such spaces, with a view to certain subjects. But the principle of adaptation is most indispensable for the painter; for if, in such a combination, the productions of painting should appear as adventitious ornaments, varying according to the taste or caprice of each artist employed, the result might be a mere gallery of pictures. This mistake seems to have been committed to a certain extent in the church of the Madeleine at Paris. The defect is said to be the more striking, as the subjects of several of the paintings relate to the life of the Saint, who is represented very differently in different works according to the conception of each painter. In such an assemblage of pictures, whatever might be the degrees of merit, the spectator would look in vain for any evidence of a similarity of aim.

It therefore appears that, whether one or many hands be employed, some common principle is necessary as a means of ensuring a due harmony of treatment. But before entering further into the consideration of this question, it may be desirable to examine the opinions that have been expressed elsewhere in similar circumstances, reserving for the concluding observations the comments which particular passages may appear to require. An Essay in the "Revue Générale de l'Architecture" may be quoted first. The remarks of the writer are suggested by the celebrated work of M. Paul de la Roche, painted in oil on a semicircular wall in the Ecole des Beaux Arts at Paris. It is unnecessary to refer to the opinions relating to that particular work, but some of the more general observations may not be undeserving of attention. The following is a translation.

"When first the architect opened to the painter the doors of a recently finished edifice, and showed him the walls which were to be adorned by his skill, an elevated art arose, the essential principles of which were at once defined by the conditions of this union. This art may be called mural, or monumental painting. Its characteristics are so pronounced, and so distinct from easel-painting, that perhaps the relation between the two might be aptly expressed by the circumstances attending their respective modes of execution; by comparing the eternal walls of a temple with the fragile stretching frame under which the easel trembles.

"Painting being employed to decorate large and solid surfaces, the artist is no longer intent on the re-production, however ingenious, of reality in its most limited sense. A dignified subject is essential, and to this genius is required to add ideality or elevation of treatment. Lastly, simplicity, the indispensable characteristic of great works, must be apparent in the composition and in the execution. Hence arises the especial condition of excluding from mural painting all that may interfere with grandeur of effect—all that aims at literal imitation and illusion. It is to be remembered that the painter is, in this case, not alone; his art is employed, together with that of the architect, in decorating the same interior. There can be no difference of purpose between these two exponents of one and the same thought; and if one art is dependent on the other, it is that of the painter. It is further to be remembered that the walls must always be felt to exist under the decorations that cover them, and the skilful and magic effects by means of which the painter gets rid of the flat surface would here be out of place.

"Thus, under whatever point of view this question is considered, monumental painting must still be limited to an elevated region, where all is grand, simple, and unaffected. It is thus that its style was defined by the great masters who, from Giotto to Michael Angelo, covered the walls of the palaces and temples of Italy with their works. They painted in fresco; and Michael Angelo, foreseeing the decline of the grandest style, had reason to call easel-painting an occupation for women.[2] From this period (the middle of the 16th century), the tradition of elevated art was unstable. Succeeding painters, down to Pietro da Cortona, poured over vast surfaces their crowded compositions in which the qualities of fresco became useless. To complete the decline of monumental art, it remained only to neglect the process itself. Accordingly, from the beginning of the 17th century, oil-painting was introduced commonly on walls, particularly in France; and the artists looking on this mode of painting as an opportunity for displaying the effects of foreshortening, perspective and colour, produced what the Italians called vast 'machine,' differing only from the decorations of the theatre by better studied forms and a more finished execution. We have no right to consider modern artists responsible for this practice; it is to be dated from those painters who first lost sight of the conditions which regulate the style of painting when that art is applied to architecture.

"The rich and varied effects which characterize oil-painting are ill applicable to a severe style of architecture. The brightness of tints, powerful relief, the finish of details, are resources easily abused, especially when the artist has been long accustomed to them. Such means require, on the contrary, to be subdued and simplified, so as not to transgress the limits of a well-understood style of decoration. To these objections it may be added that oil painting applied to walls has no principle of durability or solidity, especially when employed on large surfaces. The experienced chemist, M. Darcet, who has made science available for so many practical objects, thought that he had remedied this defect by preparing walls with new grounds for painting."

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[1] This paper forms Appendix No. 6 to the Second Report of the Commissioners on the Fine Arts.

[2] This often misrepresented expression of Michael Angelo appears to have been uttered in a moment of irritation, and to have been intended as a rebuke to Sebastian del Piombo. Vasari thus explains the occasion, in his life of that artist: "A misunderstanding arose between them, in consequence of Fra Sebastiano having persuaded the Pope (Paul III.) to direct Michael Angelo to paint the Last Judgment in oil, whereas he would only consent to execute it in fresco. But as he was silent at first, the wall was prepared for oil painting, under the direction of Fra Sebastiano. Michael Angelo suffered several months to pass without beginning, and being at last pressed to proceed to the work, he declared that he would not undertake it unless he was allowed to execute it in fresco; adding that oil painting was an art for women, and for persons in easy circumstances and of indolent habits, like Fra Sebastiano. The Frate's priming was therefore removed from the wall, and the surface was prepared anew for fresco."

The writer here refers to the dome of the Pantheon, painted by Gros, and adds, that the work has already suffered in some places.[3]

"It may be admitted," he continues, "that fresco is not better fitted to resist the action of a humid climate; yet the frescos of Mignard, in the church of Val de Grace, are well preserved, although the retouches in coloured crayons, added by the artist after the work was completed, have faded. After all, the question of durability need not be considered so all-important; even if we could succeed in rendering oil paintings on walls durable, it would be impossible to give them those qualities fitted for architectonic decoration which belong to fresco, and which caused that method to be preferred by all the great masters of the Italian schools. But although fresco admits of the design being studied to any extent in cartoons, yet in its ultimate execution it is not an art for the hesitating and timid. It requires a grand style of drawing, a broad and simple treatment of colour, an eye steadily fixed on the whole effect, and an energetic and rapid hand—all qualities which it must be confessed are rare in these days. But if fresco cannot be successfully encountered by all artists, there is another method which is at least as ancient, and which France had first the honour to revive, though its practice is now familiar to many; I mean encaustic painting, which is applicable to all grounds, and which consists in employing the colours mixed with wax, and prepared for painting by means of essential oils. The colours, which are used as in oil painting, may be blended so as to give the effect of the highest finish by subjecting them to the action of fire, by means of a cauterium. This method, which has been employed with success of late years for monumental decoration, has all the resources of oil-painting; but the artist may moderate the brilliancy of tints as he pleases, and give them to a certain extent the *mat* (unshining) but luminous tones of fresco; he may return to his work as often as he pleases; while the painting, notwithstanding the changes of temperature, attains a solidity greater even than that of fresco.

"The school of Munich, which has at least the merit of adhering to the ancient traditions of monumental painting, has employed these two methods only; one for religious and philosophic subjects, the other subjects borrowed from history and poetry."

To the above may be added the following extracts translated from a "Memoir presented to the Prefect of the Seine, by MM. Lapère and Hittorff, architects, relating to the decoration of the new church of St. Vincent de Paul."

"In the present advanced state of the church of St. Vincent de Paul, it becomes necessary to consider its permanent decoration. We have therefore the honour to submit our ideas as to the fittest application of painting and sculpture for this end.

"In studying the most remarkable monuments of the best ages of art, it is invariably found that the architect's work was completed by the production of the painter and sculptor, and that those monuments, by a happy union of the three arts, presented the most striking and attractive effect which human ingenuity could devise.

"Another circumstance, not less important, which is apparent in such an examination is that, wherever this union of architecture with painting and sculpture has produced great results, *one* directing thought appears to have influenced the whole.

"If there are few instances in which a single individual has practised the three arts with sufficient power to conceive and execute alone an entire monument, there are many to prove that edifices prepared by the architect to be decorated with paintings and statues have been intrusted to one painter and one sculptor. This was the surest means of obtaining a characteristic result in harmony with the architect's creation, and which, instead of weakening the effect of that creation, would contribute to its complete impression. It was thus that the immortal works of Greece and of ancient Rome were produced, as well as the masterworks of modern art.

"That this system was in itself judicious, is easily comprehended. The force and clearness of the idea, the agreement between the conception and the execution, in a word, harmony—that quality without which no work of art can be complete, was the result of one pervading feeling which, in the infinite multiplicity of detail, preserved the unity of a whole."

After referring to the decorated architecture of the Greeks, the authors remark that

"Many later edifices, imperfect as they may be in details, are yet admirable for this unity of impression.

"Among such examples may be mentioned the Basilica of Monreale and the Royal Chapel of Palermo, as true traditions of the principle of Hellenic art; for in these, historical painting in the form of mosaic (the only decoration employed) is so adapted as to leave no doubt in the spectator's mind on two points, viz. that the buildings were designed for the paintings, and the paintings for the places they occupy.

"We here find pictures in which the subjects, importance, number, treatment, and distribution have depended on the situations which the architect's arrangements afforded, all as if guided by one directing thought.

"In contemplating the harmony and majesty which these churches present in their masses, and the poetic and moral impression produced by their decorative details, the spectator at once feels that this grandeur of effect is mainly owing to the unity of creation. It is also easy to conceive that this impression would have been destroyed, or would have been far weaker, if the decorations had been subdivided and allotted to a great number of artists, whose works would have been variously conceived and executed. The merit of such productions, in individual instances, would not have compensated so great a defect."

The authors proceed to express their conviction that the similarity of the grounds on which the figures were painted, in addition to the similarity of style, contributes to the effect of the whole.

"The use of gold for these grounds shows, besides, that the artists did not then attempt to do away with the walls, but only to give to the stone the appearance of a precious material. The simplicity and sedateness in the attitude and expression of the figures, as well as in their execution, are not calculated to disturb the impression as to the reality of this wall of gold. Hence we find none of those abrupt effects produced by grounds of all colours and varieties, nor those attempts at illusion which in historic mural painting are so injudicious, presenting hollows where there should be solidity, undulating lines where there should be plane surfaces; in short, uncharacterizing the architectural forms—forms which painting should preserve and assist, but never alter or suppress."

The authors then refer to three kinds of art which have been revived or invented of late years, namely—encaustic painting, painting on glass, and enamel painting. The last, it is observed, combines all the qualities of mosaic and porcelain with many important advantages. The authors remark, that

"Painting even on the exterior of sacred public edifices was not confined to the south, but had been employed in severer climates. Germany and the old and new capitals of Russia contain examples. Such external decorations lasted better in Egypt than in Greece and Italy, and better in the south of Europe than in the north. Hence more durable materials are required in the latter cases. Mosaic had been first adopted with this view; porcelain, treated as it was at the revival of art, could in some degree have answered the same purpose, but nothing could fulfil all the desired requisites so satisfactorily as the enamelled lava.[4] More durable than mosaic, more under the command of the painter, so as to enable him to give the greatest perfection to his work, this beautiful invention, in its application to the exterior of the Church of St. Vincent de Paul, may rival the most remarkable effects of the kind that art has produced."

The authors afterwards propose that Raphael's compositions from the Old Testament should be executed in enamel, to adorn the cella of the portico of the new church.

In the decoration of the interior they recommend encaustic painting,

"Now sufficiently tried at Fontainebleau, at Munich, and in Notre Dame de Lorette and in the Madeleine, at Paris."[5]

MM. Lepère and Hittorff next recommend that certain prominent portions of the internal decoration in the nave and sanctuary, and which belong to the general *coup d'œil* should be entrusted to one, or at most to two artists; but the side chapels and various other places, they admit, might be allotted to various hands. They assume, however, that the universal gold ground which they propose to adopt, will compel all the artists to a sufficient unity of style and effect. The observations on sculpture are dictated by the same principle of preserving a harmony in the general effect and in the style of those works that are seen together.

The opinions of German artists and critics, on the adaptation of painting to architecture, correspond with those above quoted.[6] Mr. Wilson states in his notes:—

"Professor Hess observed to me that great care must be taken to avoid contrasts of effects in a series of pictures on the same wall. The same spirit, he observed, must pervade the whole in the design and colour, and as nearly as possible in the light and dark. If, for instance, an artist were to represent a broad daylight in his first picture, in the next a fiery sunset, and beside that again a night scene, such contrasts would interfere with the architectural unity which is essential."

[3] Compare the opinion of Mr. Wilson, before quoted.

[4] Lava slabs of large dimensions are obtained at Volvic in Auvergne; they are fire-proof, and figures the size of life are executed on them in enamel.

[5] The trials of encaustic hitherto made have in many instances been far from satisfactory, chiefly owing to the effects of damp in ill-prepared walls.

[6] See the article Fresco, in the "Conversations Lexicon."

After noticing the works in the church of the Madeleine, before referred to, Mr. Wilson quotes some defective Italian examples, and adds:—

"Paul Veronese, as might be expected, from his oil pictures, is more effective, and perhaps may be said to paint in fresco on truer principles of colour than any other Venetian master; but his taste in design is open to criticism. In the Villa Mazer he has everywhere annihilated the architect's intentions, and has so painted the walls and ceilings as to convey the idea that the spectator is looking out to the country and up to the heavens, while the windows in the room contrast the reality with the artist's intentions. Such extravagances, perhaps pardonable in the fanciful decorations of a villa, were carried to excess by the later Italian artists. Vaulted roofs of churches or rooms were frequently painted with perspectives of gorgeous edifices, while portions of clouds and figures were brought down, by means of express plastering, over the real cornices and mouldings. In S. Andrea della Valle in Rome, even Domenichino has indulged in such perverse and unworthy conceits.

"We may, on the other hand, gather from the examples of the best masters, that an idea of unity should pervade a series of pictures executed in one place; but still there are difficulties in forming a just opinion of the true mode in which painting should be thus applied. By some of the German artists the difficulty has been met by representing the pictures as tapestries nailed to the walls;[7] in other cases they have painted the figures on gold grounds, in imitation of the mosaics in the ancient Byzantine churches."

Adverting to the decoration of churches at the revival of art, Mr. Wilson proceeds:—

"Blue was substituted at a later period for gold, and this is exemplified with most completeness in the Cappella degli Scrovegni at Padua, painted by Giotto, which may be deemed a perfect example of Italian Gothic church-painting.

"In this building, as in other Italian Gothic edifices, the vaulted roof is painted blue, and is divided into compartments with stripes of ornament; in other buildings where there are ribs in the vaulting, this ornament, which is of a geometrical character, is confined to these, and to a small space on either side of them. In each compartment of the vault there are circles of characteristic ornament, in which are painted heads and even whole-length figures of the Evangelists, or their symbols. At a subsequent period the circles were dismissed, and the figures were painted standing on light thin clouds; at all times the blue background, sometimes very dark, at other times light, was spangled with gold stars, frequently executed in relief. In Sta. Maria del Popolo, in Rome, Pinturicchio has introduced a beautiful variety in this mode of decoration; he has seated the figures on thrones, and diapered the blue background with a rich gold pattern. To return to the Cappella degli Scrovegni; the paintings on the walls are divided from each other by broad ornamented bands vertically, and by narrow ones horizontally; in the vertical bands are octagonal spaces, with heads of saints, coats of arms, and subjects composed of two figures, and all these bands are richly painted with various colours. The figures are all on a ground of plain blue, of the same tone as that of the vault overhead.

"In the Farnesina, Raphael has restored the ancient mode of treatment, which had been departed from even by Giotto himself on the walls of Assisi and which was never revived by any other artist till Raphael adopted it in the above instance."

The extreme opinions of the continental artists and critics above quoted, are to be tried by a reference to the masterworks of Italian art, and by an examination of the conditions resulting from the union of painting with architecture.

Fresco having been decided on for the decoration of portions of the Palace at Westminster, the question of methods need not for the present be further discussed; but it may be remarked that the arguments for or against particular modes appear to depend on the following considerations:—the influence of the practice of a given method on the style of the artists; the inclination of the artists; durability; applicability to architecture; the resources of the method; and the convenience of execution. The absence of a shining surface for paintings on walls seems to be generally considered desirable, and in the present case is especially recommended by the architect[8] It is easily attainable in all modes, the enamelled surface above referred to excepted. The employment of other methods than fresco, it has been observed, might admit of the work being executed on strong panel, to be afterwards inserted in walls, thus avoiding the objections to canvas; but panels of the sizes required could not be easily introduced into painting rooms of ordinary dimensions. M. Paul de la Roche, who recommends painting in oil on the wall itself admits that, to avoid the black and heavy appearance which old oil-paintings thus executed present, it is necessary to adopt a light style of colour, and to admit a large proportion of illumined masses.[9] This leads to the consideration of the question of style, and of the restraints to literal imitation which are supposed to be necessary.

The gold ground, recommended by the writers above quoted, might be at once dismissed without comment, as it has never been proposed as a background for figures in the intended decorations; but it is to be observed that there is no example of it in the celebrated paintings of the great masters, with the exception of Raphael's first work in the Vatican, viz., the ceiling of the Camera della Segnatura. It may have been objectionable to them, even in works where no background was introduced, because, as is evident from the instance just quoted, it is an unsatisfactory imitation of mosaic; the comparative dulness and heaviness of the colours contrasting ill with the splendour of gold. It is just, however, to state that all who have seen the works of Professor Hess, thus executed on a large scale at Munich, have been no less struck by the general splendour of effect than by the grandeur and beauty of the inventions.

The opinions respecting the supposed necessity of preserving the flatness of the real wall, whatever means may be adopted for such an object, must be especially objectionable to painters, who feel that the triumph of their art greatly consists in apparently doing way with the plane surface. Nevertheless, it will be admitted that an art which professes to be the auxiliary of architecture, may require to be more or less modified in particular cases in order to attain the union proposed. The qualities which constitute the abstract completeness of imitation are limited, even in ordinary practice, by various causes; by the style of art, by the subject, and by dimensions, without any reference to the particular place for which the work may be destined. The conditions of situation, and of relation to a building, are new to artists in this country, but must be acknowledged to be as obligatory as those which they are in the habit of fulfilling.

M. De la Roche, though, as before observed, an advocate for oil-painting on walls, thus writes to Mr. Wilson: "Monumental painting is an art by itself, requiring no less experience than invention, and should an opportunity of the kind again present itself for me, I shall endeavour to show that I have profited by the observations which I have made during and since the execution of my work" (the hemicycle before mentioned, in the Ecole des Beaux Arts.)

The arrangements with respect to light being assumed to be satisfactory, the general conditions in question may be reduced to three—the purpose of the building, the magnitude of the halls or rooms to be painted, and the style of the architecture. The purpose of the building must regulate the selection of subjects, and, to a certain extent, their style. It is inexpedient here to enter upon the consideration of the selection of subjects, but the dimensions of the rooms are given by the architect, and must always constitute an important condition, not without some influence even on the subjects. Figures in paintings which are required to decorate vast halls may require to be larger than nature, and it will generally happen, as a consequence of such enlargement, that little space remains in the picture for background. On the other hand, colossal figures in a small room, even where the idea of a supernatural size is intended to be conveyed, are unsatisfactory, as the spectator is quite near enough to perceive details, and finds none, except those belonging to the execution of the work and which ought not to be visible. This unpleasant effect is produced in the "Sala de' Giganti," by Giulio Romano, at Mantua.

In the suite of apartments or Stanze in the Vatican painted by Raphael, the compartments for pictures are as large as they can be consistently with the size of the rooms. In the first work there executed by him, even the foreground figures are not larger than life. As the great artist proceeded in his labours, he increased the size, and reduced the number of the figures, till his eye was satisfied.

The limited distance, compared with their size, at which these works are seen, may in like manner have determined the style of execution, and ultimately in some degree even the subjects. In the Camera della Segnatura, which at first appeared to be the only room which could be allotted to Raphael (the others being then occupied by the works of older artists), the subjects, such as philosophy, poetry, &c. are abstract; but when directed to re-paint the remaining rooms, the experienced artist adopted or approved of a class of subjects which required various details, such as it is natural to look for in objects seen near.

On the same principle differently applied, when Michael Angelo began the ceiling of the Sistine Chapel, he filled three compartments with numerous small figures and a variety of incidents; but finding that such a style produced no effect from below, he suddenly enlarged

[7] There are examples of this in the Hall of Constantine and on one of the ceilings of the Stanze in the Vatican.

[8] See Architect's Report.

[9] Letter from M. De la Roche to Mr. Wilson.

the figures of the next compartment to a colossal size: they thus occupied the whole space, leaving no room for background. Having once satisfied himself as to the necessary size, he adhered to it throughout.

The tapestries executed from Raphael's cartoons were originally destined for, and ultimately hung up in the Sistine Chapel, round the Presbyterium. In the cartoon which, from the intended situation of the tapestry and from other circumstances, appears to have been executed first, viz., the Miraculous Draught of Fishes, or Calling of Peter, the figures are comparatively small; in all the rest, the size of the figures is greatly increased.[10]

These examples may suffice to show that the distance from which the spectator is supposed to contemplate a work (sometimes as a part of an extensive decoration), not only defines the size of the figures, but also regulates in a great degree the quantity of detail, and consequently the selection, or at least the treatment of the subject.

In the instances of the Stanze of the Vatican and the ceiling of the Sistine Chapel, the great artists made their own arrangements respecting the spaces or compartments. In the Palace at Westminster the distribution of the spaces has already been fixed by the architect. The distance at which paintings in the Victoria Gallery will be seen will be considerably greater than in the Vatican, not so much from the difference in the dimensions of the rooms (the Victoria Gallery being 45 feet wide, and the Hall of Constantine, the largest of the suite in the Vatican here referred to, being not much short of that measure), as from the smaller space which the architect proposes to allot to each painting. As it is, the moderate size of 12 feet is fixed.

The apartments of the Vatican to which the Hall of Constantine forms the approach, vary in dimensions and are not all rectangular. The room called the Camera della Segnatura measures about 35 ft. in the longest dimension. Single frescos, with the addition of a painted frame-work, occupy each wall. The paintings called Theology and Philosophy (or the Dispute of the Sacrament and the School of Athens) measure, without reckoning the painted frame-work, about 26 feet 8 inches wide;[11] so that the utmost distance to which the spectator can retire from either is not sufficient for the eye to embrace the whole composition. The base of the paintings is, however, above the height of the eye (in the other rooms higher than in this), which somewhat increases the distance; but in the Hall of Constantine, measuring about 60 feet by 42, the large fresco of the Battle with Maxentius, about 36 feet in extent,[12] on one of the side walls, cannot be viewed at the minimum of distance which is necessary to see the whole of a picture.[13]

The ceiling of the Sistine Chapel is about 60 feet from the ground; the size of the single compartments has no relation to this distance which would admit of pictures measuring from 30 to 40 feet wide; but the size of the figures (with the exception of those in the three compartments before mentioned) is perfectly well calculated for their situation. Those in the coved part of the ceiling, as is well known, are still larger, partly perhaps with a view to counteract the effect of the curve. The head of the Delphic Sybil measures about 2 feet, giving a height for the entire figure, if it were erect, of nearly 16 feet.

Thus, even where single paintings and compartments can be duly embraced by the eye, the Italian painters seem to have considered that the effect of each should be subservient to that of the whole wall or ceiling, though that whole, strictly speaking, could not be comprehended at one glance. Instances, it also appears, are not wanting in which the size of the apartments does not admit even of single paintings in it being embraced by the eye at once. This may be a sufficient excuse for the absence in such works of any general effect of chiaro-scuro. The principle of making the effect of the various compartments subservient to the whole scheme of decoration appears therefore to be one of the points in which the equality of architectural embellishment may, in some degree, require to be extended to painting, and in which the unpicturesque principle of repetition is in danger of superseding concentration. The resource of the painter, as exhibited in all the examples quoted, is effective composition, through which, elevation, isolation, &c., may render the principal objects striking, and a gradation of importance may be attained by skilful arrangement. There are, however, instances in which the effect of mural paintings of vast size, and which are seen alone, approach the concentration of effect common in easel pictures. A cupola seems to suggest this treatment; a single painting occupying the end wall of a chapel, or of a hall, and which may be seen at a sufficient distance, admits of the principle of concentration (subject to the conditions arising from its adaptation to architecture), inasmuch as it is a whole in itself. Thus, judging from its present remains, there appears to have been a treatment of light and dark in Michael Angelo's Last Judgment different from that of the ceiling subjects. The enlargement of the figures in the upper part of the fresco is rather to be accounted for by the principle before followed by the great artist in the ceiling, namely, that of adapting the size of the figures to their real distance from the spectator; for it may here be observed, that the perspective diminution of figures is confined to narrow limits in the works above mentioned, and in those of most of the Italian masters, Correggio and his imitators excepted. This restriction is a necessary consequence of the general aim of the severer schools—an aim which was only recognized by Correggio in subservience to his favourite qualities of chiaro-scuro and gradation. The other great painters seem to have considered that figures reduced to minute dimensions by perspective may express distance, but, in general, nothing more. The real subject of Correggio's cupolas may be said to be space; the subjects of the mural paintings of Michael Angelo and Raphael are rather human action and thought.

With respect to the attempt to do away with the real surface of ceilings by perspective appearances, a practice so much abused in the decline of art, it would be a mistake to suppose that the representation of an immeasurable space overhead, with violent foreshortening, as seen in the cupolas of Correggio, was altogether new in Italy in his time; and it would be equally erroneous to conclude that the great artist who painted for Julius II. were unacquainted with efforts of the kind. There was a remarkable and early example in the Church of the SS. Apostoli in Rome, by Melozzo da Forli, in which a foreshortened figure of Christ, represented in the subject of the Ascension, "seemed," to use the words of Vasari, "to pierce the roof."[14] Michael Angelo, of all artists, would have been the last to shrink from the difficulty of foreshortening, but he preferred the more judicious, because more intelligible and expressive representation of figures, seen as if opposite to the eye, and not as they would appear above it. In his as well as in Raphael's ceiling pictures, the horizon is often introduced as it would be in a painting on a wall.

But to what extent, is the characteristic aim of painting, viz., the representation of roundness and depth on a flat surface, to be sacrificed or limited in the adaptation of painting to architecture, and how far are the observations, on this point, of the writers above quoted to be looked upon as valid? The answer may be furnished by the examples before mentioned. From those examples it is apparent that the larger the dimensions of the figures, (the necessary consequence of the distance at which the work may require to be viewed,) the more abstract must be the representation, and the more it requires to be reduced to expressive essentials; that, on the other hand, where the spectator can only retire a few feet to contemplate a painting, the eye demands a greater fulness of parts, and more gradation; but that in no case can the imitation descend to the style of cabinet pictures, in as much as the compartments, however small, are always to be considered as portions of an extensive whole.

The apparent contradiction of the omission of detail, in proportion to increase of size, was adverted to in a paper in the appendix to the former report, and, bearing as it does on the question under discussion, may be more fully stated on the authority of various examples, as follows:—

The representation, without reference to its frame or boundary, is required to expand as it recedes from the eye; this increase of size with distance (or of distance with size) being indispensable, in order that the work, as a whole, may be duly seen. But this progressive enlargement is confined to significant forms and objects; things less important are gradually omitted, notwithstanding the general increase of size. The extreme effects of proximity and distance correspond in some respects, for works of art may be so small that their leading features only can be perceptible: this effect is equivalent to that of distance. Thus, engraved gems often exhibit a grandeur of style fit for colossal figures. On the other hand, the degrees of distance to which the style of highly-finished cabinet pictures may be said to belong, are defined by the average range of most distinct vision. Beyond and within that limit, whether the pictured plane diminishes

[10] The cartoon of Paul preaching at Athens may offer an exception: the subject demanded a display of architectural magnificence; but even here the principal figures are much larger than in the cartoon of the Calling of Peter.

[11] Passavant, in his life of Raphael, gives the dimensions 25 ft. by 15 ft., French measure.

[12] Passavant (*ib.*) and Bunsen (Beschreiburg der Stadt Rom), give the dimensions 50 palms by 22.

[13] Once and half the width of a picture is considered the minimum of distance to which the spectator can retire to see its whole surface. A circle cannot be embraced by the eye till the spectator retries to a distance equal to thrice its semidiameter.

[14] Part of this work is now preserved in the Vatican.

as it approaches, or expands as it recedes from the eye, detail is either less compatible with effective representation, or is less perceptible.

The following considerations may tend to explain the practice in art to which this statement refers. The scale of mere magnitude still increases with increasing distance, as the picture becomes enlarged, and it would at first appear that, at any and every degree of distance, the eye must continue to receive an equivalent impression. This cannot, however, be literally the case; for the scale of other qualities, such as sharpness and softness, and light and darkness, may be already complete in a picture requiring to be seen near; consequently, that scale cannot be increased by increased dimensions, while it must be reduced by increased distance. But as it becomes reduced—as sharpness, force and gradation become impaired, notwithstanding the increase of dimensions, the omission of detail becomes unavoidable; for it is essential to completeness that the quantity of parts should not surpass the existing technical means of expressing their relative importance.

The restrictions which in this instance are a consequence of distance and dimensions, are more or less expedient in all modes of imitation in which the organ of sight is less fully informed. The incompleteness in the appearance, as in the case of the absence of colour in sculpture, being compensated by greater general distinctness, and by a representation unencumbered by accidents.

Perhaps the most remarkable examples of this relative completeness or independence of style occur in the outlines and monochroms of Greek vases. In these works, the line being assumed to vary but little in thickness, the means of representation may be said to be reduced to the lowest degree. Yet a certain gradation is still preserved. The quality of smoothness in forms is expressed by the omission of internal markings; without background, the scene is indicated by a significant stenography. Parts only of some objects are introduced; others (the presence of which may be inferred or imagined from the position of the figures) are entirely omitted; as if that which reduced figures to a mere outline, rendered subordinate objects invisible altogether.

Flaxman has shown that the language of abstract form (apparently requiring no addition of light and shade to assist its meaning) can be employed quite as emphatically with less convention; but the same general principles are recognised in his designs.

The consistency which is maintained even on so limited a scale, is not less apparent in the works of great artists, in modes of imitation which afforded ample means of expression. From the restricted department of art referred to, in which so much beauty was nevertheless condensed, to examples of painting, which have exhausted the resources of imitation, the world has always awarded its approbation to completeness of style, and to the docility which has kept it in view under the conditions of subject, material, place, and dimensions.

Sir Joshua Reynolds observes that Michael Angelo, in the Sistine Chapel, attempted little more than could be attained in sculpture; nevertheless, it has been remarked that the ceiling of that chapel, as an example of decoration and of the due adaptation of painting to architecture, has never been surpassed.[15] The inference is, that distance, large dimensions, and the grandeur of style which is the result, are favourable to the fulfilment of the union proposed. But although there are few examples of perspective or of backgrounds in the compositions of the Sistine Chapel, the individual figures are remarkable for roundness, and the fresco of the Last Judgment may originally have exhibited the quality of depth in a remarkable degree.

The extreme doctrine which assumes the necessity of aiming at flatness, because a wall is flat, may therefore be pronounced erroneous on the authority of the best mural paintings, and may be considered unnecessary, even as regards the end proposed. As a proof, it may be sufficient to remember that examples of oil-painting in which the effects of aerial perspective have been represented with consummate mastery, when hung up in a room are immediately seen to be flat surfaces, more or less agreeably coloured. At the same time it is apparent that the breadth of treatment which must ever be an attribute of "monumental" painting, must tend to reduce the fulness of relief. The limitation of chiaro-scuro which this supposes, involves, however, an especial attention to colour, and it is to be observed that the practice, common with the painters of Venice and Friuli, of executing large figures, calculated to be seen at a considerable distance, on the exterior of buildings, may have led those painters to feel the importance of depth of local hues, and the necessity of laying a stress on the permanent rather than on the mutable qualities of nature. The requisite which M. De la Roche thinks essential, viz., the predominance of light masses, is quite compatible with this aim; and the lightness of effect, without deficiency of force, which is the result, is a quality seldom wanting in Italian frescos. Those by Annibale Carracci, in the Farnese Palace, form a remarkable contrast to the heaviness of some oil-pictures by the same master.

With respect to the alleged expediency of intrusting the execution of a series of pictures to a single artist with a view to unity of effect, it appears, from the examples before given, that the change of style consequent upon first experiments, which may be exhibited in a series by a single artist, may interfere as much with architectural symmetry as the varieties of treatment resulting from the employment of many.

In the instance of the frescos in the Stanze of the Vatican, it should, however, be remembered, that although the contrast which some of those works present to the rest might not have been satisfactory had they formed a series in a vast hall, yet as each picture occupies an entire side, and is seen almost alone, the incongruity which to a certain extent exists is not apparent. Again, the architectural and other back grounds, which are sometimes elaborate, might have been too prominent had the compartments been of the ordinary shape; as it is, their semicircular form sufficiently reduces the space above the figures.

The condition of a peculiar style of architecture is altogether a question of taste; even authority here fails, the greatest Italian masters never having been called upon to paint in a Gothic building. The example which is most applicable may be found in the works of Luca Signorelli, at Orvieto. In those works there can be no doubt that the artist's object was not to imitate, but to surpass the ruder productions which may have been executed, there or elsewhere, about the time when Italian-Gothic structures were erected. The Tudor style of Gothic (the style of the Palace at Westminster) is coeval with the highest development of art in Italy; and buildings erected in the time of Henry VII. or Henry VIII. might have been decorated by the hand of Raphael, had he accepted the invitation of the last-named monarch to visit England.[16]

From the foregoing considerations and examples it appears that, whether the decoration of a wall or ceiling consist of one or of many paintings, the treatment should have reference to the whole extent of such wall or ceiling; and that, consequently, if the compartments be small, that circumstance does not of itself involve the necessity of a corresponding style. Hence the dimensions of the figures are not always referable to the size of the compartments, but are rather calculated for the distance from which the whole, or a considerable portion of the decorated surface can be conveniently viewed; and the usual consequence is that little space remains in the pictures for background. The cartoons of Raphael may in general be cousidered as models in this respect, the tapestries for which they were designed having been to all intents permanent mural decorations. It may here be further remarked that, when figures differing in size from those in the principal compartments are introduced among the architectural embellishments, they are often painted in chiaro-scuro, or in imitation of bronze, gold, or some such material, or, if imitative of nature, the subjects are supposed to be on tapestries. Such portions thus profess to be works of art, and the difference of size, as compared with that of the figures in the principal compositions, involves no inconsistency. Such, with occasional exceptions, examples of which have been before noticed, was the practice of the Italian painters.

[15] The remarkable alteration in the size of the figures before referred to, interfering as it does with the architectural symmetry, is not however to be overlooked.

[16] Dallaway's Walpole, vol. i. pp. 106—187.

ARCHÆOLOGICAL INSTITUTION OF ROME.—The annals of last year's proceedings of this Society have been recently published, and contain drawings and description of the Temple of Mount Ocha, near Carystus, in Eubœa, communicated by Professor Ulrichs, of Athens. This temple is generally believed to be the oldest and best preserved specimen of the kind in Greece, and is particularly remarkable for the massiveness of its walls, and the peculiar structure of its roof. The prize proposed by this Academy in 1842, for the best essay on the Coinage of Italy, has been gained by Dr. Achille Gennarelli, author of the text of the "Museo Gregoriano." He opposes many of the opinions advanced in the work published by Marche and Tessieri, under the title of "Aes grave del Museo Kercheriano," which although up to this time the standard work on Italian coinage, was yet so faulty as to induce the Archæological Society to propose a prize for another on the same subject.

ST. MARY'S CHURCH, READING.—During the course of last month three very ancient sedilia, of the early English architecture, were discovered in ruins behind the wainscotting on the south side of the chancel, the fresco painting at the back of them and the encaustic tiles being still in excellent preservation.

THE PHILOSOPHY OF CORAL FORMATIONS, AND THEIR ARCHITECTS.

Coral (Corallium, Lat. from κορη, *a daughter*, and αλος, *the sea;* so derived by Minshew, because it is generated from *the sea;*) generally described as an animal growing in a plant-like form, or a congeries of animals of the polype kind: there are 15 genera at present known to us, embracing numerous species. The ancients are wholly silent on the subject of coral reefs and their architects, their knowledge, according to Dioscorides and Pliny, being confined to the white and red corals of commerce, of which they enumerate six varieties or various shades, from dull white to bright red or scarlet, the latter being held in the highest degree of estimation by the Romans, who classed them among the most valued gems. But although silent, it cannot be supposed that they were altogether ignorant of their existence, the Red Sea, sometimes termed by the Hebrews the Sea of *Zuph*, or *Weeds*, having been navigated from the earliest ages by the various tribes bordering on the coasts, the dwellers of ancient Mesopotamia carrying on a constant trade of drugs, spices, &c., with Egypt, Syria and Palestine, and eventually with European nations. We are therefore to assume that the perilous reef and its beautiful architects were well known to them, as they are to the Arab and Abyssinian traders of the present day, under the general term of stony plants or weeds. Cæsalpinus, Boccone, Ray, Tournefort, Geoffroy, and Hill, class coral among marine plants, maintaining that it is propagated by seed like unto vegetables, and Count Marsigli, who was a very attentive observer, supposed he had discovered its flowers and fructification; but the more minute observation of M. de Peyssonnel led to the discovery that what Count Marsigli mistook for flowers, was no other than a congeries of minute insects inhabiting the coral; for upon taking the branches out of the water, they immediately retired into the cellular cavities, re-appearing on immersion in water. Recent observations by Linnæus, Ellis, and others, confirm these latter views to a certain extent only, for in the face of these authorities, and of many indisputable facts, it is still a subject of dispute as regards fungi, sponges, and other species, and throughout the whole, the link of life between the animal and vegetable kingdoms is so finely drawn as to be indivisible, the beginning and the end being lost in the subtilty of nature's workings.

The coral polyps, which are invisibly minute in their atomic structure, perform a most astounding part in the production of earths, and of fossil and mineral compounds. Governed in their distribution by habit and generic character, they generate in groups and families in localities favourable to the propagation and increase of their kind; or they are disseminated by the tidal currents, or by organic or inorganic substances to which they attach themselves, throughout the various regions of the element in which they live. In the colder latitudes, or in the lower depths, they are known as naked polyps, being of the lowest order of organization and simplicity of structure, gelatin and albumen together, or gelatin alone, with sea water, being the chief, and in many instances their sole elementary compounds: but, as they approach the surface of the waters in temperate or tropical regions, their organic structure becomes more rigid, and to the above simple material is added, calcium, magnesium, sodium, iron, ammonia, marine acids, and other well known products, by which, in warm and tranquil seas, they become the unconscious architects of hills and chains of hills, mountains and chains of mountains, rising above the waters as islands and portions of continents.

The coral polyps are living but not sentient bodies, being mere impulsations of life; they are rapidly generated in warm and tranquil waters, and as the grasses of the field, as rapidly disappear before the influences of climate, of disturbance, and of the countless creatures of the deep that prey upon them. Preserved from those contingencies common to all forms of life, such is the peculiar economy of their structure and organic action, as to admit of a very brief period of individual existence, the tender offshoot, like that of the flowering shrub, being soon hidden in the more consolidated structure of the compound body; every simple body, however minute on its parts, having limits to its extent, such limits being defined by and depending in its nature, quantities, and qualities, and the influences by which it is generated and governed: every compound body having also limits to its extent, such limits depending, in like manner, on its nature, quantities, qualities and local influences, the same being perfect results of the day, still perfecting by acquisition of parts and quantities, and passing through the brief but successive stages of development, from birth to maturity and from thence to decay.

Many of these bodies propagate their kind by separation of parts, every particle of the body having capacity, under favourable circumstances, to produce life; thus species are propagated and sustained: of such are the naked polyps. Other species increase by the multiplication of their parts until they have attained a certain size, defined by the accidents of clime and association; and becoming matured, their gemma or buds drop off, and carried away by the waters, are generated therein, affixing themselves to some organic or inorganic body where they increase and multiply their species; others are permanently fixed to their primary bases, and increase by multiplication of parts in a manner precisely similar to the growth of plants, ramifying into shoots and branches, and becoming eventually one peculiar body of a plant-like form, and having the appearance and qualities characterizing species. The progressive development and growth of fungosa or mushroom species in the ocean and on the earth is precisely similar, although the one is said to belong to the animal, the other to the vegetable kingdom; both the one and the other spring from corruption or decomposed organic matter—both are developed by a gradual enlargement of the entire body, stem and crown produced by multiplication of parts—both attain a defined size and form distinguishing species and characteristic qualities—both multiply by their seed given forth through their cellular cavities—and both are incapable of propagating by slips and cuttings. The same beautiful coincidence may be remarked in many of the madrepores and millepores, their organical, mechanical, and chemical action similating with terrestrial plants, each having root and stem, branches and leaves, each having its ascending and descending sap, and a governing action embracing the whole system; the stems of the corallines are composed of capillary tubes whose extremities pass through the calcareous crust, and open into pores on the surface, and such is the disposition of plants. Many of the corallines consist of a single tube, as for instance, Tubelaria, or pipe coral; here the tube rises in the form of the cup of a flower, such as the primrose: at first it is merely a flesh-like film contracting towards the base when taken from the water, and expanding when replaced in it; this film, consisting of gelatin, calcium, and sometimes a small portion of animal oil, is the germ of the body, which strengthens with its growth, and finally becoming rigid, its individual organic action is impeded, its progeny appear and close the apex, and thus they continue to ramify into joints, and when united in groups and families, the whole contribute to form one vast catacomb, many of these jointed tubes rising up together, the living crowning the whole, and still continuing to increase so long as they are uninterrupted by destroying causes. These polyps have the usual characteristic of animal matter, but their mode of generation and development fully justify Dr. Paris and others in insisting upon their belonging to the vegetable kingdom. The same may be said of other species of the Polypiers Calciferes, which in the place of a woody fibre have a calcareous substance mixed with their animal juices, or forming their outward covering, the like organic action and development being common to the vegetable kingdom.

Polyps pass through the like gradations of change with shell fish or tender succulent plants; those of most calcareous nature not excepted. The stony polyps develop two distinct stages of existence; in the first they are naked and flexible, and it is in this state that they are mistaken by naturalists, on the one side, as tentacula of the animal, on the other as the flowers and fructification of the vegetable body. The fungous matter covering some, and the flesh-like matter exuding from or covering others, is the rising progeny of the consolidated mass beneath, convertible, and converted in the course of time into like consolidated matter; the basis beneath the external covering of fungous matter consists of consolidated matter in which vital action is still manifest, and consolidated matter in which vital action is extinguished, the latter being in many cases converted into solid limestone rock, or as is manifest in the corals of commerce, the degree of organic action similates to that of forest trees. The Madrepora Fungitis, as Rumphius observes, while living is covered with a thick viscid matter like starch, the more elevated folds or plates having borders like the denticulated edges of needle-work lace, which are covered with innumerable oblong vesicles formed of the same gelatinous substance. This, and the coarse visible rind, is the active portion of the compound body appertaining to its calcareous bases, and drawing its

vital action therefrom, as well as administering nourishment thereto, as it consolidates by abstracting its food from the medium in which it moves, so its lower portions gradually assimilate to the calcareous basis on which it is placed, and new offshoots arise to vegetate in turn their fleet existence, until they enter the second stage, and eventually into the fossil kingdom. It is upon the gelatinous viscid matter covering the surface of corals and coral-lines that the animals of the deep feed, it is to the vast plains covered with half naked and naked polyps, that whales, turtles, and other species repair to revel in abundance, cropping the surface, which is rapidly renewed again. Mr. Darwin is decidedly in error when he talks of fishes browsing upon the coral branches; it is true that calcareous matter is often found in the stomach of fishes, particularly those of the coral species, but it is equally true, as previously observed, that many of the polyps, while in their soft state, contain a great portion of calcareous matter, and to the continued increase of this matter the coral owes its eventual solidity. On the other hand, the generality of species while living, are filled with a milk-like fluid, fat, sharp, and astringent, and in some of the Gorgonia in particular, so powerful are its effects, as to draw blood when applied to the tongue, for while in the living state a strong electric excitement is evident in the living system: it is also a fact that minute or naked animalculæ are seldom, if ever, found located on the coral branches, the intruders being generally shell-bearing animals of like constituents with themselves. And finally, months of observation among the coral reefs have convinced the writer of this article that the delicate branches always remained uninjured by fishes, which feed upon them as ants feed upon the aphides, robbing them of their sweets alone, and leaving the body uninjured.

Lythophyta, Tubipora, Millepora, Madrepora, and Fungosa, propagate their kind through the means of their juices, which exuding from the parent trunk, fall upon the surrounding soil, become attached thereto, and if circumstances be favourable, are speedily generated, being governed in their first development by electro-chemical action, where light and heat are necessary adjuncts; in their increase, by the forces which govern vegetable bodies in their multiplication of parts; and, in their advance towards maturity, by the laws of organic life as their organical structure becomes developed. Their food is received through the cellular pores, and consists of water and the atomic particles floating therein, which, received into the living system, undergo chemical change, forming products similating with the organic body, eventually converted into the milk-like fluid, which, like the sap of a tree or the blood of an animal, pervades the whole system. From the development of the gemma or buds in many species to their full maturity of growth, they exhibit all the phenomena of terrestrial plants, being uniform in their development, growth, and decay, and propagating by their seeds and cuttings.

This similarity of action and organical arrangement would at once identify them with the vegetable kingdom, was it not for the animal matter manifest in all of them; it is certain that they differ little from fucuses and confervas, and like them are uniform in their growth, development, and decay; we can therefore only come to the conclusion that Life throughout nature is ONE, although differing in degrees; that by nature animal has no distinction above vegetable life, but acquires powers, under favourable circumstances, from the superiority of its elastic compounds and peculiarity of its organic action, which is not distinguishable in lower organizations: that when organic action is impeded by the rapid secretion of calcareous matters, the body or form, unless under intense energy of light and heat, and other favourable circumstances, is not enabled to pass the boundaries of simple organization, such as distinguish vegetable bodies: and so far as respects the stony polyps, the mixed qualities which compose the juices and the animal framework, as lime, soda, magnesia, &c. are inimical to their attaining any considerable size, or to the development of nerves, marking an advance in organic character. As regards life, they may, therefore, be considered as one with the vegetable kingdom, and that while the animal matter secreted by the functional operations of life identifies them as belonging to the animal kingdom; the action of life by which their animal matter, carbon, lime, ammonia, and other compounds are produced, and the organs of reception, retention, and motive power, by means of which they draw their nourishment from the medium in which they live, as also the act of procreation by division of their parts, and the ultimate development of peculiar form to a definite extent only, and the organical arrangement of the several compounds of which the body consists, as strongly identify them with the vegetable kingdom.

The colourless pellicle which distinguishes many species of the zoophyta planta, and is also distinguishable in some of the stony species, is formed in every individual of the vegetable kingdom; the cellular texture is formed from the membranous in like manner, varying in form in different genera and species; the ligneous fibre is substituted by the stony matter, which supports and constitutes the solid part of the body, being also formed by a series of depositions, which, after the body has attained maturity, gradually encroach upon the vascular vessels, and, by arresting further circulation, destroy the vital principle. In like manner with vegetables, many species are permanently fixed upon bases, advancing in their growth towards the rays of the sun in the direction of light and heat, and this vegetative process is manifest, not only in the Zoophyta Planta, but also in numerous species secreting lime, as sea ferns, sponges, madrepores and millepores.

Many of the stony polyps, while in the living state, continue soft and yielding to the touch, but as the sap vessels fill up, they gradually indurate, and if this take place beneath the waters, they become converted into limestone rock; thus it is with the beautiful Meandrina spreading over its consolidated bases in moss-like clumps: its external covering is exceedingly soft, similating to the living sponge, and as it enlarges, so it enlarges on every side; its animal matter is converted into a kind of bony substance, which is filled with living juices passing to and fro through the whole system, until the entrance to the cellular pores becoming filled up, the lower portion dies, but still remains attached to the living body.

The time that each species requires to perfect its growth is very variable, necessarily depending upon latitude, dip, and inclination; and again, upon its preservation from those numerous accidents to which it is subject in common with all forms of life, such as local or general disturbance of the medium in which it is placed, or the predatory warfare urged against it by almost all the living species of the deep. An erroneous idea is entertained by men of science, that the stony polyps are of exceeding slow growth, such being the natural consequence of their consolidated nature; thus Ehrenberg calculates that the specimens of Meandrina seen by him in the Red Sea were at least 2000 years old; but these, it would appear, were of the dead and not of the living coral; and even if living, the calculation is ridiculous, for, in fact, they attain a very great size in 20 years when uninterrupted in their growth. In tropical regions, where they enjoy heat and quietude, their growth is exceedingly rapid, rivalling, in this respect, terrestrial plants and grasses; but like the latter they are the food of myriads of creatures which greedily crop off the flesh-like surface, and thus retard their growth. In the lower depths and beneath temperate climes, like the leaves of the forest, they die off annually, or, otherwise, their growth is retarded by adverse circumstances of low temperature and local disposition. Much also depends upon their freedom from tidal disturbance, for the tender and delicate gemma or buds of many species are easily washed away by the ocean tides, or destroyed by the intrusion of sands, or other matters inimical to their freedom of action or alien to their nature.

Some idea of the time required to mature their growth, may be derived from our knowledge of the growth of the white and red corals of commerce, in the Mediterranean Sea. Marsigli informs us that the white coral of this sea is most abundant in caverns to the south, and where the sea is smooth and tranquil; that it is seldom found in a western exposure, and never to the north; that when the caverns are despoiled of it, ten years are allowed by the fishers for its regeneration, and in this time it attains its extreme height and thickness; at greater depths it disappears. This is confirmed by Spaglanzani, who says that in the neighbourhood of San Stephano the coral does not attain half a foot in 10 years, and in proportion to its depth so it deteriorates in quality, and gradually disappears; that the greater quantities are at depths varying from 60 to 125 ft., and some fisheries are carried on to the depth of 900 ft.; at this latter depth it is said to require 40 years to attain the same size which, at the depth of 60 ft., it attains in 10 years. In all parts of the ocean, local influences determine the time requisite for maturing the coral. M. de Peysonnel found that the coral grows in different directions, sometimes perpendicularly downwards, sometimes horizontally, and sometimes upwards, and in the caverns of the sea open to every exposure. Lamouroux remarks, "we find some polypidoms placed always on the southern

slopes of rocks, and never to that towards the east, west, or north; others, on the contrary, grow only on those exposures, and never to the south. Sometimes the position is varied according to latitude, and the shores inclined towards the south, in temperate or cold countries, producing the same species as the northern exposures of equatorial regions." Again, it is evident that the duration of their existence is variable; some are but the creatures of an hour, of a day, of a few months, falling off and disappearing according to their nature, and to the climate to which they are subjected; thus in the colder seas, numerous tribes are cut off every winter to be renewed in spring. Some continually throw off their parts, and thus new generations are produced, and these gemmules being carried away by tidal action, or by attaching themselves to locomotive animals, cause such tribes to be more generally diffused. But although, as Lamouroux remarks, many species are periodically destroyed, it must not be supposed that entire destruction takes place, the matured portion of the compound body remaining, as a tree stripped of its leaves, being reclothed with verdure in the ensuing spring, and still adding to its strength and size by multiplication of its imperishable parts. In tropical countries, where the heat is general, the polyps spread abroad over the valleys and troughs of the deep, without reference to inclination, as in colder seas, their nature and qualities being determined by the temperature and depth.

The present accepted term of polype is much too vague and undefined to be rightly understood, being made to embrace many animals of higher organization; thus, according to the present acceptation of the term, every plant and every animal may be classed as polype—every organic body, whether it be animal or vegetable, increasing by the multiplication of its parts. The term polype ought, therefore, to be confined to those simple organic bodies which act independently in their parts and quantities, so that on separation, the several divisional parts, as in the hydræda and other species, they experience no loss of power in this division, but still continue their functional operations, being perfect results in their separate state, and perfect results as one whole. On the other hand, there are species of coral and corallines where life is in entirety as in shrubs, and some of these cannot be propagated by slips or cuttings.

Numerous species are, from their nature, confined to particular localities of the water, or to certain depths; others are generally, and some are universally, diffused, maintaining their form and qualities under every latitude; but with few exceptions, locality has a marked and determinate influence in their organic structure, and in their qualities and quantities, which almost invariably depend on food and temperature, in consonance with the known laws governing all animated nature, for beneath all latitudes like Causes produce like Effects; when the temperature and local and general action similate, the results similate also. Thus the stony corallines and corals abounding in eastern seas, are of similar conformation and character to those dwelling within western and southern seas; and thus it is in the uniformity of living species, there is a uniformity of matter produced by the functional operations of life, the depositions of matter forming strata composed of oceanic organic bodies and their decomposed particles, being the unerring indication of the temperature under which they lived and propagated in their generations. Thus the fixed or locomotive animals or animo-vegetables which secrete lime, and by deposition age upon age, form hills and mountain chains of calcareous matter and of solid limestone, (such, for instance, as much of the British strata is composed,) make us acquainted with the primary causes of effects produced, being unerring indications of the vast and wonderful changes which this planet has undergone, and which it must still undergo ere the end of nature is accomplished; such organic beings as are hourly manifested to us, having of necessity existed and propagated within a medium and beneath a temperature adapted to their habits and character; thus it is that every formation of chalk, oolite, ocean marl, and calcareous matter, however remote from those latitudes in the present day, however far removed, however high it may be elevated above the present level of the sea, however changed and disguised by time or circumstance, must, while generating and perpetuating their species, have been beneath tropical and quiet seas during those ages requisite for the completion of so vast a mausoleum.

The calcareous polyps, comparatively speaking, are scarcely known in the depths of northern seas; the delicate corallines are equally scarce in the depths of tropical seas, species being most abundant in latitudes where there is warmth and tranquility; all in their growth advance towards the rays of light and heat: but where the sun is nearly vertical, they extend themselves in every direction, without reference to latitude and dip. The sponges, sea mushrooms, millepores, and many species of madrepore, together with echini, sea worms, and numerous other species, are seldom found at any considerable depth, intense heat communicated through the shallow aqueous medium and refracted from the calcareous bed, being most favourable to the full development of many species, and essentially necessary to the existence of others. In proportion to the degree of heat, so is the quantity of lime, soda, magnesia, and other compounds.

To those who have seen the splendid collection of corals in the British Museum, I would observe, that in many of the beautiful specimens, such as Astrea and Meandrina, they behold the skeletons alone. The beautiful convolutions of the one, and the star-like appearance of the other, were once covered with their animo-vegetative covering, exhibiting varying colours, as green, blue, purple, white, &c.; the now empty cells were then replenished with living juices circulating throughout the compound body; the dendrophillia, sensitive to the slightest touch, contracted its beautiful flowery head; and Gorgonia, approaching nearest to terrestrial shrubs, interposing its dark twigs, gave relief and additional interest to the fairy scene, mimicking the fairest gardens of the earth; the sponge too, light and tremulous to the touch, was then filled with a thick viscid juice, and many species, now rigid as marble, while living, waved their branches to and fro as agitated by the tides, or by the passing monsters of the deep.

In all and through all, we find the link of animal and vegetable life to be so finely drawn as to prove inseparable; the nature of the material may differ, but the mechanical action of the one and of the other at all times assimilates, and in both we observe a beautifully graduated scale of life, from the simple spark or mere impulsation, to the most elegant and complicated form, from the simplicity of union of primary principles to the development of innumerable proximate principles and atomic compounds. Philosophic observers of polyps may discover in their elementary properties, actions, and sensibility to external impressions, identifying their animal organization, but the body formed is one body, and, in numerous genera, is governed by one influence; and in these, the act of the tentacula is extrinsical and involuntary; not depending on the will of matter placed within the cellular cavity, but upon the internal filament which passes through and connects the whole in place of nerves, or upon the vital fluid, whose action pervades the whole. It is of no real importance to man to be assured that the lethophyta and keratophyta are animal or vegetable; the great and important question is, what part do these minute developments of living action, fixed or locomotive, simply gelatinous, or converting into stone, perform in the economy of nature? From whence is derived the material of the animal or vegetable body? The important part they perform in giving increase to the earth and to the most ponderable bodies of which it is composed, is manifest at every step we tread, in every region of the waters; the simply gelatinous and albuminous animals attach themselves to every consolidated substance, and propagate like the grass of the field, thus ere the oyster has attained maturity, its calcareous covering becomes the basis of a world in miniature: the rock, the mineral body, and the ocean bed are concealed from observation by the incrustation of countless myriads; the waters teem with animalculæ, with numerous organic species, destroying, or becoming the prey of others: as local influences determine, so they propagate or are destroyed; and, favoured by heat and quietude, so they diverge into species, and exhibit new phenomena.

In my next I shall proceed to consider the importance of the lime secreting polyps in the economy of nature, and the results manifest in all parts of the earth.

H. G. M.

(To be continued.)

LIFE-PRESERVERS AT SEA.—Experiments have lately been made at Leith harbour on a newly-invented safety cape, which may be worn, and thus preserve a person from the danger of drowning in any depth of water; and likewise a pillow inflated with air. Two persons jumped into the sea thus protected, and exhibited several means of preserving the lives of shipwrecked mariners.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

INSTITUTION OF CIVIL ENGINEERS.

April 11.—JOSHUA FIELD, V.P., in the Chair.—*(continued.)*

Screw Cutting.

Some specimens were exhibited of screws cut in lathes constructed by Messrs. Shanks and Co., of Johnstone, near Paisley. They were sent by the late Sir John Robison, who described the principal advantages of the arrangement of the lathe for cutting them to consist in the cutters acting during the incursion as well as the excursion of the slide, and when forming long screws, in their being alternately stayed on the side opposite to the tool which was in action; that by these means, good work could be produced with such dispatch, as to reduce the cost of turned screw bolts, as low as that of similar articles produced by screwing machines, which worked with dies acting by compression.

A drawing of the lathe used in cutting the screws was presented with the specimens.

Mr. Field observed that the machine was ingenious and appeared to do the work well; but as far as could be ascertained from the drawing there was not any novelty in it. A similar machine made by the late Mr. Maudslay, had been in use in Maudslay and Field's manufactory for the last 15 years. The screwing dies invented by Mr. Whitworth, cut out the threads of screws as clearly as if done by a chasing tool, and entirely without compression.

April 25 *and May* 2.—The PRESIDENT in the Chair.

"*An Account of the Brick-making at Blechingley Tunnel, during the winter of* 1840 *and summer of* 1841." By Frederick Walter Simms, M. Inst. C. E.

As the forming of this part of the Dover Railway was not let by contract, it was necessary to make extensive preparations previously to commencing the work, and amongst these the brick-making department was one of the principal, the whole being under the personal superintendence of the author. The bricks were all made on the surface along the line of the tunnel, the brick-grounds being so arranged on each side of the shafts, that when the bricks were delivered from the kilns and stacked, but little labour was necessary to convey them to the spot, whence they were lowered to the underground works. The mode of manufacture adopted was that of "slop-moulding," in which process the mould is dipped into water previous to its receiving the clay, instead of its being sanded as is the case in making sandstock bricks; the workman then throws the clay with some force into the mould, pressing it down with his hands to fill all the cavities, and strikes off the overplus with a stick; an attendant boy, who has previously placed another mould in a water trough by the side of the moulding table, takes the mould just filled, and carries it to the floor, where he carefully drops the brick from the mould on its flat side and leaves it to dry; by the time he has returned to the moulding table and deposited the empty mould in the water trough, the brick-maker will have filled the other mould, for the boy to convey to the floor where they are allowed to dry, and are then stacked in readiness for being burned in clamps or kilns. Minute details of the manufacture are then given, the average results of which are shown in the following table:—

Force employed.	Area of Land.		Duration of Season.	Produce per Week.	Produce per Season.
	Roods.	Prchs.	Weeks.	Bricks.	Bricks.
One moulder ..... One temperer ..... One wheeler ..... One carrier boy ..... One picker-up boy	2	14½	22	16,100	354,200

A careful comparison is then made between the two modes of sandstock and slop-moulding, from which it appears that while the production of sandstocks is as 30 to 16 of the slop process, the amount of labour is as 7 to 4, and that the quantity of land required and the cost of labour per thousand are nearly the same in both processes. The bricks were all burned in close kilns constructed with soft bricks set in pugged clay, the quantity burned in them at a time varying from 30,000 to 40,000. The fuel employed was that known by the name of the Bell Robson Netherton, or South Hartley coals, and for the purpose of more accurately determining the cost of this element, the author caused the quantity of coals consumed in burning 94 kilns of bricks to be carefully noted: this is given in a table accompanying the communication; the average of it is, that 10 cwt. 8 lb. of coal were used, in burning each thousand of bricks. The floor of the drying-houses was made of pugged clay about nine inches thick at the furnace end, and gradually diminishing to two inches at the extreme or chimney end, so as to equalize the heat of the floor. The temperature of the interior of these drying-houses when in full operation varied from 50° to 70° Fahrenheit. The estimated cost of the bricks delivered at the shafts was 2*l.* 1*s.* 10*d.* per thousand; but the actual cost, obtained by dividing the total expenditure by the whole number of bricks made, was only 2*l.* 1*s.* 6*d.* per thousand, which includes waste and all other expenses that were incurred.

The author notices the substitution of Mauritius sugar mats for the ordinary hack-caps made of straw, and that they were durable and serviceable.

The paper is accompanied by two drawings showing the elevations and sections of the kilns and drying-houses with their flues.

Remarks.—In answer to questions from several members, Mr. Simms stated that the price of moulding bricks by the slop process was 5*s.* per 1000; that slop bricks occupied less time in drying than sandstock bricks; that the former kind were full one pound each heavier than the latter, which he attributed to the greater amount of pressure they received when being moulded; for this reason also the sandstocks were made somewhat quicker. The price of the ordinary hack-caps made of straw was 4*d.* each, and they lasted one season; the Mauritius sugar mats which were substituted for them, cost about 1*d.* each and would last two seasons.

Mr. Bennett thought that the quantity of bricks which could be produced by each gang of men was under-rated, for, at Cowley, the average number of sandstocks moulded was 32,000 per week; while his men very frequently made 37,000, and sometimes they reached as far as 50,000. The space occupied for moulding at Blechingly appeared small; in Mr. Bennett's brick-ground 10 stools occupied 20 acres; this might arise in some degree from more time being allowed for drying in the sandstock process: he believed this to be an advantage; the principal part of the shrinkage took place while drying previously to being burnt. The total amount of contraction in his bricks was $\frac{13}{16}$ inch in 10 inches; but all clays differed in the amount of contraction.

Mr. Farey directed the attention of the meeting to Hunt's improvements on the Marquess of Tweeddale's machine for making bricks; it had not, he believed, yet been brought into general use in England, but it was employed extensively at Hamburgh and other places on the continent, and was stated to produce stronger and better shaped bricks, of more uniform quality than those made by hand moulding; the process was a kind of intermediate one between slop and sand-moulding; the moulds being wetted as in the former process, while the clay was tempered in a pug-mill as in the latter process.

A very ingenious system of moulding without wetting the clay had recently been introduced by Mr. Prosser of Birmingham. At present the system was confined to the production of buttons, small tiles, and slabs for painting; but the patentee asserted that the machine could be advantageously used in making bricks. A few had been made which in burning only shrunk $\frac{1}{80}$th of an inch in 9 inches.

Mr. Bennett said the Marquess of Tweeddale's machine had not been adopted generally, because of the first cost, and that the necessity for employing horse power, or a steam-engine, for working them, rendered the bricks more expensive than when made by hand.

Mr. Homersham stated that steam or horse-power was not indispensable; that Messrs. Simpson and Co. had made several of Hunt's machines for the Tweeddale Brick Company to be worked by manual labour, and that they succeeded perfectly. He found the bricks so produced about one-sixth stronger than those made by hand, which he attributed to the degree of pressure to which they were subjected.

Mr. Simms objected to the use of machinery chiefly because it would only effect an economy in the moulding, which was but a small part (about one-eighth) of the expense of making bricks.

The contraction of the bricks varied according to the nature of the clay employed; the moulds used at Blechingley were 10 inches long by 5 inches wide and 3 inches thick, and the bricks when burned were 9 inches long by $4\frac{3}{4}$ inches wide and $2\frac{1}{2}$ inches thick. The chemical constitution of different clays, and the relative proportions of alumine and silex contained in them, would be a subject of much interest and practical utility, to be brought before the Institution by some member possessing the necessary chemical knowledge.

Mr. Bennett mentioned the existence of a brick machine invented by Mr. Ainslie, and now working in Scotland; it was, he believed, somewhat cumbrous, and required to be driven by steam power, but he had understood that it produced very good bricks and tiles, but was chiefly employed to make the latter.

In answer to a question from the President, Mr. Simms said that the bricks at Blechingley had been made without any cavity in the top and bottom, in order not to waste the cement in which they were laid. Engineers entertained very opposite opinions as to the utility of the cavity in the bricks.

Mr. Cubitt preferred the bricks having a cavity, if they were to be laid in mortar; with cement it was of less importance.

Mr. Farey believed that when the cement was stronger than the bricks,

cavities on the surfaces were desirable, but if the bricks were good and stronger than the cement, the cavities were not necessary.

Mr. Farey exhibited specimens of tiles, &c., made by Mr. Prosser, of Birmingham, and described the process of manufacture. The clay was first dried upon a slip kiln as if for making pottery, then ground to a fine powder, and in that dry state it was subjected to heavy pressure in strong metal moulds: by this means it was reduced to about one-third of its original thickness, but the clay appeared to have contained sufficient moisture to give it cohesion, and the tiles retained the most perfect sharpness at the edges—they were then carried direct to the kiln, and baked in "saggers" or crucibles, without any previous drying, and they did not appear to crack in baking. A brick of the usual dimensions, which was exhibited, had been made by this process from the common brick-earth of Staffordshire, ground fine: it was of a clear red colour and of homogeneous texture, and the edges were sharp; its weight was 6¾ lb. and the specific gravity was 2·5.* Mr. Farey stated that this brick was not vitrified, but merely baked, and that it had acquired its density from the great pressure used, which was equal to 250 tons.

Mr. Pellatt had seen Mr. Prosser's machine at work, making buttons and other small objects; the ground clay appeared to retain a certain degree of moisture which, combined with the pressure, gave it such tenacity, that on leaving the mould it could be handled and carried direct to the kiln; it was compressed to about one-third of its original thickness.

The clay of the Staffordshire potteries contained chiefly silicate of alumine; it was principally valuable for, and was employed in, making "saggers" or crucibles wherein the china was baked. The clay from which the china and crockery-ware was made, was brought from Devonshire, Dorsetshire, and Cornwall, and was used with certain mixtures of silex and other substances according to the manufacture.

Mr. Blashfield stated that of the specimens of Prosser's manufacture on the table, the small hexagonal tile 3¼ inches diameter and three-eighths of an inch thick, had sustained a pressure of 30 tons, without the edges being crushed; another of the same diameter and 2⅛ inches thick, bore 35 tons, and the 9 inch stock brick remained perfect under a pressure of 90 tons: the largest sized slab hitherto produced by the process was 34 inches long by 8 inches wide, and half an inch thick: but he believed that as soon as the new hydraulic presses were completed, it was Mr. Prosser's intention to make large bricks of varied forms for architectural purposes.

In reply to a question from the President, Mr. Cowper explained that the tiles, &c., after being subjected to the pressure, were released by the action of a treddle, which raised the bottom of the mould, and thus brought out the object without injuring its edges.

Mr. Hunt exhibited a model of the brick-making machine (see *Journal* for June last, p. 202) used by him, and described its construction and action. The principal working parts consisted of two cylinders, each covered by an endless web, and so placed as to form the front and back of a hopper, the two sides being iron plates, placed so that when it was filled with tempered clay from the pug-mill, the lower part of the hopper, and consequently the mass of clay within it, had exactly the dimensions of a brick; beneath the hopper, an endless chain traversed simultaneously with the rotation of the cylinders; the pallet boards were laid at given intervals upon the chain, and being thus placed under the hopper and the clay brought down with a slight pressure, a frame with a wire stretched across it, was projected through the mass of clay, cutting off exactly the required thickness of the brick, which was removed at the same moment by the forward movement of the endless chain; this operation was repeated each time that a pallet board came under the hopper. Mr. Hunt stated that the chief object of the machine, which was worked by hand, was to produce good square compact bricks, of uniform quality, using only a slight pressure. He had found that it was very difficult to dry bricks made by machinery where considerable pressure was employed; because, before the evaporation from the centre of the clay was completed, the surfaces were overdried and they frequently scaled off. These machines were in operation in several parts of England, producing usually about 1200 bricks per hour, and each machine required two men and three boys to feed it, turn it, and to take off the bricks; the clot moulders were dispensed with, and all the persons employed were common labourers; professed brick-makers were thus not required; he found this of much importance in the contracts which he had taken for making bricks, both in this and in foreign countries.

The machine for making tiles (*Journal* for June, p. 202, Fig. 2) is on the same principle as Fig. 1; it consists of two iron cylinders, round which webs or bands of cloth revolve; by this means the clay is pressed into a slab of uniform thickness, without adhering to the cylinders. It is then carried over a covered wheel, curved on the rim, which gives the tile the necessary form; the tiles are polished and finished by passing through three iron moulds of a horse-shoe form, shown in the centre of the cut; they are at the same time moistened from a cistern placed above them. The tiles are then cut off, to such lengths as may be required, and carried away by an endless web, and are placed by boys on the drying shelves. Flat tiles, or soles, are formed in nearly the same manner, being divided into two portions while passing through the moulds; the quantity of clay used for one draining tile being the same as for two soles. In answer to questions from the President, he stated that the density of the bricks could be augmented, but in that case, the time required for drying them must be increased, and frequently artificial means were resorted to, which rendered them more expensive.

Captain Buller inquired whether any advantage was obtained by the production of bricks of such a density as that exhibited by Mr. Prosser; whether builders would not consider them objectionable from their great weight, the difficulty of handling and cutting them, and the increased expense of carriage. He had understood that the lightness of the London bricks, which was chiefly owing to the ashes used in their composition, was considered an advantage, and that they were sufficiently strong for all building purposes.

Mr. Parkes was of opinion that the weight of Prosser's compressed bricks would be objectionable for ordinary purposes, and he did not think that the mortar generally used would adhere to such smooth surfaces as they possessed. The Roman bricks were very dense, but they were small in proportion, and they were used with mortar or cement which had been carefully prepared for a long period before it was used. The Dutch clinkers, which were so very durable, were small in proportion with their density; and the same might be observed of all foreign bricks, some of which were made with great care; for ordinary work he should prefer a brick of a less dense quality than the compressed ones.

Mr. Blashfield explained that Mr. Prosser's bricks could be rendered lighter, by an admixture of ashes or other substances with the clay, if it was considered desirable.

Mr. Newton had recently examined a wall which had been built with very dense bricks, and had twice fallen; the bricks appeared to have absorbed the moisture from the mortar, before it could adhere to their surfaces. He promised to exhibit on a future occasion, some bricks which were brought from the pyramids of Egypt; they appeared to be composed of sand mixed with chopped straw, and had not much cohesion; yet they were strong enough for the construction of such massive buildings as the pyramids.

Mr. Hunt said that engineers generally preferred dense bricks as their works required strength; he had found it advantageous to use mild clay instead of a stronger quality, as compact bricks made from the former, when well-tempered, were better than those of the same density made from the latter.

Mr. Fowler said that the value of bricks depended upon their strength: but he doubted whether density and strength were in this case synonymous; and he thought that bricks of a cellular structure would not only be stronger, but would unite better with the mortar. He thought, however, that Mr. Hunt's machine would prove advantageous, as the bricks produced by it would be of more uniform character than those made by hand moulding.

Mr. Pellatt believed that light bricks were generally porous, and that when they were used for building external walls the moisture soon penetrated; this was not the case with dense bricks, and if they were generally made more compact, thin walls would resist damp as well as thick ones.

Mr. Cowper believed that for architectural purposes so much density was not absolutely necessary. Houses three stories high had been constructed by the mode of building called "Pisa" work, which was merely ramming down tempered clay into moulds of the thickness of the walls, and allowing the mass to be dried by the sun as the work proceeded. In countries where the climate was very dry this method succeeded perfectly.

Mr. Braithwaite understood that several kinds of brick were made for the London market, that they were devoted to different uses and were sold at various prices; some qualities were capable of supporting a great amount of pressure, and were generally used with cement, while others were almost rotten.

Mr. Bennett said that the principal varieties of bricks were called "malm paviors," "stocks," "grizzles," "places," and "shuffs"; for the first kind the clay was washed and selected with care: the bricks so produced were of superior quality. The other kinds were all made from the same clay merely tempered, the difference between the sorts being produced entirely in burning them; common stocks were good enough for all ordinary building purposes; but the inferior qualities could not be trusted for important works. As to the relative prices of the several sorts, the difference between malm paviors and stocks was 15*s.* or 20*s.* per 1000; between stocks and places 10*s.*; the grizzles obtained a price midway between the two last named, and the shuffs were sold for an inferior price governed by their quality, as they were frequently quite rotten.

Mr. Lowe inquired what object there was in the mixture of "breeze" or ashes, with the clay for making bricks; was it intended to render them less dense, or to assist the combustion, when in the clamp or the kiln?

Mr. Bennett believed that the principal advantage of using a mixture of ashes with the clay was, that it rendered the combustion more regular, when the bricks were burned in open clamps; the sifted breeze was employed for fuel instead of coal, which would otherwise be used for burning in close kilns.

Mr. Hunt explained that the method of making bricks in the vicinity of

* The average weight of Hunt's machine-made bricks is 6 lb. 7 oz., and of Cowley Stocks, 5 lb. 5 oz.

London, differed from that of almost all other places, because the material employed was not pure clay; it was a substance nearly resembling loam, of a slightly cohesive nature, which would not admit of its being used in the natural state and burned in close kilns with coal, but that with an admixture of ashes it became sufficiently tenacious to be formed into bricks; the ashes performing the same office as the chopped straw did, in those made by the ancient Egyptians. Of the sixteen hundred millions of bricks made annually in England and Wales, about one-fifth part only was made according to the London method, with a mixture of ashes. As to the density, he did not think that the weight of bricks should be received as an index of their quality; for bricks made by exactly the same process and equally compact, would be heavier or lighter, as they were made of strong or of mild clay, and yet their strength would be equal.

Mr. Pellatt observed that nearly if not all argillaceous or aluminous earths were, with certain modifications or admixtures, suited for making bricks. The term silicate of alumine, might include the various earths, whether denominated clay, marl, loam, argile, &c. The best fire bricks were made from native clay, containing alumine combined with a large proportion of silex. The cohesive or plastic property arose from the former, but too much of it rendered the bricks fusible. As most of the common clays contained a large proportion of alumine, with occasionally lime or other fusible substances, a mixture of coarsely pulverised burnt clay, sand or cinders, became necessary, in order to counteract that tendency. Alumine had a great affinity for silex, as well as iron and sulphuric acid, and the large use of cinders as a mixture with the London clay might be accounted for, not only as it reduced the proportion of alumine to other substances, but because it had a tendency, when submitted to heat, to carbonize the sulphates, and to diminish the fusibility of the brick. Bricks made of common clay could not be burnt under the same high temperature as fire bricks, and they contracted much more in burning. All dry substances, which were used to decrease the proportion of alumine, in making bricks or crucibles, were included by the French under the general term of "ciment." The most useful properties of "ciment," when well pugged or kneaded with the clay, were to hasten the drying, and to diminish the contraction, and the consequent risk of breaking in the kiln: the addition of "ciment" was economical for fire bricks, particularly when they were manufactured at a distance from the mines; the fire clays of Stourbridge, Newcastle, and Glasgow, were found amidst the coal strata; Stourbridge clay was the most esteemed, and when carefully picked, ground, sifted, &c., would bear, for brick-making, two proportions (by weight) of burnt clay or "ciment" to one of native clay. The sagger clay from the Staffordshire potteries was also a fire clay, and was well suited for making tiles or bricks of a compact character, but was probably more liable to be vitrified than the Stourbridge clay. China clay, or the "kaolin" of the Chinese, was decomposed felspar, called in the potteries "Cornwall stone;" the undecomposed felspar was interposed with it, and used by the French and the Chinese as porcelain glaze, the term used for it by the latter was "petuntse." The constituents of "kaolin" were—

According to Dr. Ure.	Murray quoted Vauquelin's analysis—	Murray stated Vauquelin's analysis of Hessian Clay to be
Silica 52	Silex 74	Silex 69
Alumina .. 47	Alumina .. 16·5	Alumina .. 21·5
Oxide of iron 0·33	Lime 2	Charcoal .. 1
	Water 7	Oxide of iron 8

Mr. Parkes believed that in addition to the ashes giving a cohesive character to the material of which the bricks were composed, they were of advantage in the process of burning, because they enabled the fire to spread gradually from the lower tiers, through the mass in the kiln, without permitting an intense partial heat, such as sometimes occurred where coal alone was used, the effect of which was, that all the bricks around were vitrified and their surfaces became glazed. He had given some attention to the subject, and had tried experiments, by ascertaining accurately the quantities of ashes and of water which were incorporated with the loam in a certain number of bricks, and had found that the evaporation, during the process of burning, exceeded that of any steam boiler, as it amounted to as much as 14 lb. of water by 1 lb. of breeze. The mode of making bricks near London was peculiar to the district, and the workmen did not understand any other method; the blue clay was not used because they did not know how to work it. In a work published by Mr. Aikin,[1] which was a selection from the papers read before the Society of Arts, the subjects of brickmaking and pottery were very correctly treated.

Mr. Dickinson observed, that the ashes used in making stock bricks, could not supply the place of the straw now discovered in the Egyptian bricks, because the process of burning would have destroyed the straw as it appeared to do the ashes; he had burned bricks extensively in clamps and in kilns, and it appeared to him that the ashes assisted in fluxing the brick earth, for on breaking a good stock brick it was always found that the interior appeared to be vitrified, and was extremely hard, and he remarked, that if the ashes worked in with the clay in pugging, either exceeded or fell short of the ascertained proper quantity, the bricks were fragile and less durable.

[1] "Illustrations of Arts and Manufactures," by Arthur Aikin, p. 17, 12mo. London, 1841. The paper, with additions, was published in the *Journal* for October, 1841, vol. iv. p. 340.

May 9.—The PRESIDENT in the Chair.

"*Observations on the periodical drainage and replenishment of the subterraneous reservoir in the chalk basin of London.*" Continuation of the paper read at the Institution, May 31st, 1842.[2] By the Rev. J. C. Clutterbuck, M.A.

The author commences by answering an objection founded upon a passage of Conybeare and Phillips' Geology (Book 1, chap. IV. sec. 11) which was urged against his former statements. The water, it was said, appeared to rise in different places to different heights—at Mile End it stood at the level of high-water mark in the Thames; at Tottenham 60 ft.; at Epping 314 ft.; and at Hunter's Hall, two miles beyond Epping, at 190 ft. above that level. Especial stress was laid on the height to which the water was supposed to have risen in the well at Epping, namely, to within 26 ft. of the surface, and to 314 ft. above high-water mark. It appeared from a note appended to the statement referred to, that the first 27 ft. from the surface of this well consisted of gravel, loam, and yellow clay, and that after sinking 200 ft. and boring 220 ft., as no water was found, it was considered a hopeless labour, the boring was discontinued, and the well covered over; that at the end of five months, it was found that the water had risen to within 26 ft. of the surface; from which it might be inferred, as was afterwards proved, by information obtained from the owner of the well, that this supply of water was to be attributed to a landspring, and was not derived from the sand of the plastic clay formation, to which the boring had not penetrated. Having thus answered this objection, it is shown that a line drawn from the water level at Hunter's Hall to mean tide level in the Thames, 10 ft. below high-water mark, would cut the level in the other wells, and give a water level dipping at an average inclination, very nearly coinciding with that insisted on in the statement to which the objection was raised. It appeared that the difficulty of determining the exact dip of the water level between the river Colne and London, had in some measure been removed, by the sinking of three wells in the direct line of the author's observations, namely, from the river Colne one mile N.E. of Watford, in a straight line to Edgware, and thence by the high road to London; the information thus obtained, proved the general correctness of the author's former calculation as to the line that would represent the natural water level. It is then shown that a line drawn from a point three miles south of the Colne, at the level of that river, or 170 ft. above Trinity high-water mark, to mean tide level in the Thames below London Bridge (a dip of about 180 ft. in 14 miles, or an average inclination of 13 ft. in the mile) cuts the water level at the point whence it is drawn, at Hendon Union Workhouse, and at Cricklewood, between that place and Kilburn, whence it may be inferred that up to this point there is no apparent trace of a depression of level caused by the exhaustion of water under London.[3] At Kilburn, the water level (which is known to have stood some years since about 20 ft. higher than at present) is considerably depressed below the line so drawn, which depression may be attributed to the influence of the London pumping—it is suggested, that it is desirable that the wells on the confines of London, and throughout the district, should be periodically measured, to ascertain at what distance, and in which direction this yearly increasing depression may be found to extend. The author proceeds to describe a phenomenon connected with the periodical replenishment of that portion of the London basin which underlies the London and plastic clays, and which cannot, as in the upper or chalk district, be fed by infiltration. This phenomenon is by him called the "oscillations of the water level," caused by the irruption of rain water, which runs from the surface of the London and plastic clays, and which sinks into the subjacent chalk through "swallow holes," on its arrival at the outcrop of the sand of the plastic clay formation. This point of irruption lies to the southward of the river Colne, and forms the line of demarcation between the clay and chalk portions of the surface of the London basin, leaving a belt of the latter varying from two to three miles, or more, in width, between the river and the outcrop of the clays. The water level rises to a point within the outcrop (called the fixed summit level) at an angle of not less than 10 ft. in the mile, when most depressed by the springs; below an angle fixed on as the lowest line of inclination to which the water in the chalk will fall. From the fixed summit the level declines towards London; in the line taken, it is found at the level of the Colne, three miles from the river. After heavy rains, when the clays throw the water from their surface, the irruption of water may be seen at the outcrop of the sand of the plastic clay formation;

[2] Minutes of Proceedings, *Journal* vol. V. page 385.

[3] The surface levels on this line having been obtained, and a section having been made, the line drawn from the two points, namely, three miles south of the Colne, to mean tide level in the Thames, enabled the author to determine the height to which the water was found to rise at Hendon Union Workhouse and at Cricklewood (the only points at which the height of water could be ascertained) in both cases to within three feet.

the level will then be raised in proportion to the quantity of water which passes through the sand into the chalk beneath it, the elevation of level extending towards the river in a ratio increasing with the distance from the river; the fixed summit will remain unaltered, until the level at the point of irruption has attained an elevation at which the water can flow towards the south. After a period of protracted drought the level will decline in the same ratio as it had risen, until it assumes a line in which little or no variation can be traced. In a given line from the Colne at Watford, to the village of Bushey, 1½ miles distant, in the autumn of 1841, the level was found to rise from the river, at a regular inclination, to a point within the outcrop of the clays. After heavy rains, the level, near the swallow-hole which receives a large body of water, began to rise rapidly, the fixed summit level not being affected till the level, at the point of irruption, rose above it; the total rise at the point of irruption was 20 ft., and at the fixed summit 2 ft. The position of the summit level had then varied from the fixed summit to the point of irruption; coincidentally with this elevation the level under London rose also, and began to decline at the same time that the level, at the point of irruption, sank below the fixed summit. The subsidence of the level at the point of irruption, was—in April, 4 ft.; May, 3 ft.; June, 2 ft.; July, 1 ft.; August, 9 in.; September, 6 in.; in October, and to November 8th, 1½ in.; the average inclination, from the fixed summit to the river, then being about 15 ft. in the mile. The subsidence of the level to this inclination, was coincident with a visible defalcation in the product of the springs discharging themselves into the river Colne. In the autumn of 1842, and in the preceding spring, similar effects were observed, both as to the rising of the level at the point of irruption, and the coincident elevation of the level under London. This oscillation of level has been traced at various points, both to the east and west of that here described. It is probable that near the junction of the Colne and the Ver, the level dips directly from the level of the latter river, at a point where the plastic clay extends itself under the Colne to the margin of the Ver. This suggests the probability of that to which the author alluded in his former communication—namely, the possibility of connecting a periodical defalcation observed in the waters of the Ver or the Colne, at those seasons when the water is short, with the exhaustion of water under London. The evidence in favour of this supposition has been strengthened, during the past year, by a repeated coincidence of variation in the London level with the supply of water in the river. The height of the water in the river (about 210 ft. above Trinity high-water mark) gives the same average inclination of level towards London as observed in other places, and strengthens the probability that the supply of water to the river may be affected at this point by the London pumping, the daily increasing demand of which will, if (as is contended) there be any ground for this supposition, very soon put this question beyond a doubt.

Remarks.—Mr. Dickinson said, that Mr. Clutterbuck's observations had been caused by a project for obtaining a supply of water for the metropolis, from wells to be sunk in the valley of the Colne. It had been stated, in support of the plan, that the rapidity with which the rain water percolated into the bowels of the earth, in a great measure prevented evaporation, and hence it might be assumed, that the quantity which descended upon the surface of the chalk found its way, with very slight diminution, into the fissures below. This reasoning was not in accordance with the deductions Mr. Dickinson had drawn from an extended series of observations, and, fearing that his mill property might be injured by the diminution of the supply of water, he had opposed the project. He had found it necessary, several years since, to investigate strictly the nature and extent of the supply of water to the springs and rivers of the chalk district, for which purpose he had a common rain gauge, which was corrected by observations upon that kept in the same district by the Grand Junction Canal Company; he also fixed a rain gauge on the principle suggested by Mr. Dalton, which demonstrated the quantity or proportion of the rain falling on the surface, which descended so far into the earth as to be beyond the reach of evaporation, and, therefore, must be calculated to reach the internal reservoir of the country whence the springs were fed. This gauge demonstrated that the greater part of the rain that fell on the surface, was either consumed by vegetation or evaporated. It furnished information of the most valuable kind, both as regarded his mills and business, and as to any engineering operations, having reference to the perennial supply of water in the springs and rivers of the district. Mr. Dickinson presented a tabular statement of the comparative result of his two gauges for the last eight years, pointing out, as was generally the case, that none of the rain-water penetrated to the springs between the 1st of April and the 30th of September. He also stated that the indications of the gauge were not only certain, but that they preceded generally by about two months, any thing that could be deduced from the observation of wells, with reference to the effect upon the rivers; and that, as to the latter, the only guidance to be derived from the state of the wells, was from those in the higher range of the chalk, because, along the valleys where the streams flowed, the level of the wells continued nearly the same throughout the year.

Mr. Clutterbuck perfectly agreed with Mr. Dickinson as to the satisfactory results yielded by Dalton's rain-gauge; but he had, from the first, expressed an opinion, that the same practical results might be obtained by a periodical measurement of the wells, in any part of the chalk district. If a line was taken, extending from the river or vent to a point midway between the rivers Gade and Ver, or any others, and observations made during different periods of the year, and the same periods of different years, the height to which the water rose or fell, would indicate the quantity which had actually percolated to the water level, and would give the relative quantity to be delivered out by the springs. The ratio of alternation throughout the line would be maintained with such undeviating regularity, that by the measurement of the wells at the two extremes, the rise or fall of all between them might be calculated with the greatest exactness. He had chosen, by way of illustration, a portion of the line, of which a section, three miles in length, was given, extending in a direction north and south between the rivers Gade and Ver, a locality whence a considerable portion of the water, which in part moved the machinery at Mr. Dickinson's mills, was derived. He took the seasons which govern the supply of water, as shown by Dalton's gauge. In the season 1840-41, the gauge indicated the percolation of less than 5 in. of rain, a quantity which must be far short of that which found its way to the water level. The gauge recorded no percolation of water immediately after the melting of the snow on the 16th of January, 1841, within a month of which time the level rose in some localities more than 15 ft. To make a proper estimate of the quantity of water to be delivered from the springs, it was necessary to ascertain the state of the level before the percolation commenced; to this the rain gauge was no guide; but by Mr. Clutterbuck's observations he was enabled to determine the exact relasive depression of the level. The first day taken was September 13th, 1841, between which period and November 8th, the level rose at one point 18 ft., and at other points in due proportion, which distinctly proved that "the indications of the rain-gauge do not precede by two months any thing that can be deduced from observations on wells." His next observation was February 14th, 1842, showing the highest point at which he measured the level, giving a total rise of 34 ft.; though from observations elsewhere it must previously have risen even higher, and have fallen to that point in consequence of the accelerated drainage caused by the breaking out of springs at higher levels, when the water in the chalk attained a certain elevation. On the 7th of May the level had fallen considerably, and on the 24th of October had declined to within a few inches of the same level as in the September of the previous year. In the season 1841-42, Dalton's gauge indicated the percolation of 17·98 in. of rain; in 1842-43, 10·64 in.; but from the causes before alluded to, and from the rain not having percolated till a later period, the level continued to rise till May, consequently the quantity of water then in the chalk was greater in proportion, than as 10 to 17. He conceived that the great practical question was, what supply might be reckoned upon from the 1st of May to the end of October? The reply to this was, he contended, more distinctly given by his observations than by the indications of Dalton's rain gauge. With reference to the rapidity with which the water found its way from the surface to the level, except when there was a great quantity of rain within a very short period, the percolation would be gradual, as indicated by a steady and progressive rise in the wells, which he had ascertained to amount sometimes to 1 or 2 in. in a day in the upper district, and continued generally to the beginning of May. In the neighbourhood of the swallow-holes the level rose very rapidly: a well sunk 50 ft. in the chalk, in which the water stood at 40 ft. from the surface, was affected within 15 hours after a late heavy rain commenced; the quantity of rain, which amounted to 1 in. in 12 hours, appeared to have retarded by a fortnight the exhaustion of that portion of the level to the south of the Colne, which is fed by the irruption of water through the swallow holes. On a former occasion, between the 10th and 25th of November, 1842, there fell on the surface 3·88 in. of rain; the level near the swallow-holes rose 6 ft. within the same space of time. When the water had reached the level, the influence of one part on another was very rapid: thus when the distant level was raised, as Mr. Clutterbuck had described, there was a simultaneous rising of the level under London. The continuity of the level, as shown in his section, was the best evidence in favour of the supposition, that the water to London was mainly supplied from the source to which he had attributed it. He had not met with any evidence in favour of the supposition that a distinction was to be drawn between the water from the chalk and that from the sand; he believed that it was all derived from the chalk, whence it rose into the sand, to which there appeared no impediment. At the points where the water broke through the sand, it invariably sunk into the subjacent chalk, a space being left between the bottom of the sand and the top of the water; following the water level, it might be traced in the chalk, and rose into the sand when the surface of the chalk sunk below the inclination at which the water level dipped towards London: from whence he inferred that the whole level of water might be called the "Chalk water level."

Mr. Simpson reiterated his opinion respecting the waters in the sand and in the chalk being different. He had seldom found the water from those strata stand at the same level, and in the majority of instances, the water from the chalk rose to higher levels than that from the sand. Towards the west of London, prior to 1830, there were numerous cases of overflows from bore-holes; and he believed, from an account drawn up by him from actual inspection of the wells when they were sunk, or soon afterwards, and which he presented to the Institution, it would be found that in the majority of instances of overflowing wells the water proceeded from the chalk. This paper gave an account of 67 wells, detailing in several cases the various strata passed through, and in all, the total depth, the levels at which the different qualities of water were met with, the quantity of water yielded, and the height to which the main supply rose in the well. He had found from recent inquiries, that in many of these wells the water had now ceased

to overflow. It would appear that as the number of wells and bore-holes had increased in some districts, the water levels had been depressed; in several cases, the cause of this had been traced to wells which had been bored at extremely low levels, and in others to the increased pumping.

Messrs. Worsencroft and Brothwood, of Hammersmith, who practised well-sinking extensively some years since, were most succcessful in wells where their competitors had ceased working when they had pierced some distance into the sand strata, whence the water only rose to some distance beneath the surface; but by continuing the boring down into the chalk, they obtained overflowing wells.

Mr. Scanlan said that the difference between the water from the two strata was easily discovered by analysis: the water from the sand contained common salt and no lime, while that from the chalk contained lime and no common salt.

Mr. Clutterbuck said, in answer to Mr. Simpson's objection as to the identity of the chalk and sand water levels, the disparity of level that he spoke of, occurred in localities where there was an exhaustion by over-flowing Artesian fountains, in which case a discharge of water was created below its natural level, which would cause the same kind of depression either in the sand or the chalk, as that which was caused by pumping the same quantity of water from a corresponding level where the water would not flow above the surface; the only difference being, that in the former the depression was permanent, and in the latter it was coincident with the temporary exhaustion of the pumps. As the water was discharged from the Artesian fountains more rapidly than it rose through the sand from the chalk, a permanent depression took place in the wells sunk into the sand, whilst a lesser depression occurred in the chalk, and thus caused a disparity of level. Thus the water level, in the wells sunk into the sand in London, was temporarily depressed by pumping from others in the neighbourhood, and the level was regained when the pumping ceased.

Mr. Braithwaite eulogized the industry and observation of Mr. Clutterbuck, and he hoped that he would extend his investigations to the point of the outcrop of the basin of the river Thames, which he had stated to be near Woolwich. He must, however, dissent from the author's views as to the supply of water to the sand under the plastic clay, being derived from the chalk, and also, that if no rain fell during a period of three years, the water in the wells referred to in the section, would retain their relative levels, at an inclination of not less than 10 ft. in a mile. He believed that any continuation of dry weather, which would affect the land springs, would also diminish the filtration, and the upper part of the basin on all sides would be affected before the greater depths. He also differed from Mr. Simpson as to the supply for the overflowing wells at Kingston, Mitcham, and other parts, being from the chalk; on the contrary, he was of opinion that it proceeded from the sand under the plastic clay, and he instanced Mr. Palmer's well at Kingston, and that sunk by Mr. Clark at the Kingston Union. The latter well was within 100 yards from the former: it was 420 ft. deep to the sand spring, and the water rose to within 7 ft. from the surface. While the water stood at this level in the well at the Union, it overflowed at Mr. Palmer's; but when the level at the Union was reduced by pumping to 20 ft. from the surface, the water at Mr. Palmer's well ceased to overflow: thus, he contended, establishing the fact that the water in both wells was derived from the sand, and not from the chalk.

Mr. Clutterbuck observed that the reason why there was a depression observable at Kilburn, and not at Cricklewood, was easily explained, if the depression caused by pumping in London was laid down on a diagram. In the centre of London the depression amounted to 50 ft. below Trinity high-water mark; at the Hampstead Road, to 38 ft.; and at the Zoological Gardens, to 25 ft. This line, if produced, would show a depression below the natural water level at Kilburn, and fall into the non-depressed level about Cricklewood. Though it was impossible to prove the assertion, that the water level in the chalk would never assume a less inclination than 10 ft. in the mile, he was led to the supposition by observing that the level ceased to decline when it became depressed to that extent; and many wells at a distance from the vent, which at the time of such depression cointained only 3 ft. of water, were never known to become dry.

Mr. Clark stated that he had found the water rise from the chalk to very different levels in the various wells and bore-holes which he had sunk, and he had not observed that the supply of water was affected so immediately after rain as had been described by Mr. Clutterbuck. He presented a paper containing memoranda relative to wells sunk and bored for a considerable distance on both sides of the river Thames. This document gave the depths at which the chalk was arrived at and the water was found, and the height at which it stood in several wells round London. It stated also, that in London the average depth to the chalk was 220 ft.; that the water generally rose to within 70 ft. of the surface, but that near the river it rose to within 50 ft. In some particular cases, such as the Lunatic Asylum at Wandsworth, the depth to the chalk was 323 ft., yet the water rose to within 30 ft. of the surface.

Mr. Davison presented a copy of a drawing made in the year 1822, showing the depth of sinking and of boring, and the height to which the water rose, in ten of the principal wells in London at that period, which it was remarkable was exactly Trinity high-water mark. It appeared also that the water did not now rise in the same wells to within 50 ft. of that point, showing a depression of nearly 2 ft. per annum. [4]

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

THIRTEENTH MEETING, 1843.—*Held at Cork.*

(From the *Athenæum.*)

(Continued from page 324.)

TIDAL OBSERVATIONS ON THE FIRTH OF FORTH, AND OF THE EAST COAST OF SCOTLAND.

Mr. Scott Russell read the concluding "*Report of a series of Observations on the Tides of the Firth of Forth and of the East Coast of Scotland,*" noticed in last month's *Journal.*

These observations extended over several seasons, and no complete report had been hitherto presented, as the observations of each former season had only shown the necessity of further extending the observations. The observations of the first season had proved the existence of certain anomalous tides, which had not formerly been accurately examined, and proved that these anomalies were more extensive than was at first conceived. Next season the observations were more widely extended, so as to comprise the whole phenomena, including many adjacent places, to which the same anomalies were traced; and thus the general nature and extent of the phenomena were determined with accuracy and precision, and reported to the last meeting. But it was found that great differences of opinion existed with reference to the cause of these ascertained phenomena, and rendered it obvious that the observations required to be extended still further, in time and extent, in order to settle conclusively the questions which had arisen out of the former inquiries. But this last series, from their extent and completeness, had now been so fully examined and discussed, as to afford ample means of deciding on the nature of the phenomena, and determining their origin. Simultaneous observations had been made at nearly twenty stations on the east of Scotland, from Newcastle and Shields to Inverness, and as many as 2000 observations a-day registered and discussed. The results of these were exhibited in the tables and diagrams accompanying the report: and the result of the whole had been to elucidate, in a remarkable manner, the mechanism which propagates along our shores and rivers the great ocean wave, which carries from one place to another the successive phenomena of the tides—in such a manner as could not have been attained by any system of observation less extensive than that which had been adopted. It is pretty generally known that the phenomena of the tides with reference to their generating cause, the influence of the mass of the sun and of the moon in the various relations of distance and direction of these luminaries, have recently been examined with great success, in a series of researches carried on, first by Mr. Lubbock and then by Mr. Whewell, partly with the co-operation of this society. By means of their labours we are now enabled to predict, with unlooked-for accuracy, the time of high water, and the height of the tide in many of the harbours of Great Britain. But many of the local phenomena of tides remained unaccounted for, and these had been the object of a special series of researches, of which the present formed a part; the object being to determine in what way the conformation of the shores, and of the bottom of the sea, and the forms of the channels of rivers and friths, affect the phenomena of the tidal wave. The rivers Dee and Clyde had been formerly examined with this view. To these were now added the Forth, the Tay, and the Tyne, and the northern shores of the German Ocean. The manner in which these observations were conducted, is not the usual one, of noting down simply the hour at which high water occurs, and then the hour of low water, along with the height at which the water stands at these times. Such a method had been found quite inadequate to the purposes for which such observations are required, and, indeed, he thought it of importance that all tide observations should, if possible, be made in the manner he was now about to describe, especially all tide observations made for scientific purposes. This plan was, to carry on simultaneously at the places examined, a series of continuous observations, every five minutes night and day, by successive observers, without intermission, for the period of a month, or of several months, as might be required. Printed forms were sent to all the stations, and in them, the observers simply noted down every five minutes, the height of the tide on a graduated scale placed before him.

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[4] In a letter to the Secretary of the Institution, dated April 28, 1843, Dr. Buckland says, "I think that Mr. Clutterbuck has added many new facts in confirmation of the theory he maintained last year, as deduced from his observations previous that time. He has also, I think, found a satisfactory solution of the apparent anomaly afforded by the well at Epping. I consider the series of observations he has been making near Watford, to be very important as throwing light on the movement of the subterraneous sheets of water which supply springs and rivers. I believe these observations to be correct, as I know that he has been indefatigable in collecting facts, and I consider them calculated to illustrate a problem of high interest to civil engineers as well as to geologists."

Every day at noon all these papers were sent by post to the central station, and immediately on their arrival, the papers of the different stations were compared, and their observations laid down on paper, so as to give a graphical representation to the eye of all the observations, by means of which, they were at once verified and compared with great facility. From the examination of these tide-waves thus laid down, certain characters of the tide-wave peculiar to each locality had been discovered. As in the former observations of the Clyde and the Dee, it had been found in this series, that the form and dimensions of a channel produce important changes in the form of the tide-wave. Where the sea was deep and the shore open and abrupt, the form of the tide-wave was symmetrical, and of the form predicted by Laplace, where he says, that in rising and falling, the water covers in equal times equal arcs of a vertical circle. This is the form of the ocean tide-wave; but, on approaching a shallow shore, and travelling along a shelving coast, the tide-wave undergoes two changes—its summit becomes displaced forwards in time, its horizontal chords become dislocated, and the wave ceases to be symmetrical. This peculiar dislocation and displacement are characteristic of a littoral tide, and in the case of running streams, the currents still further affect the tide-wave, and give to it a peculiar distortion characteristic of fluvial tides. To these were further added the exaggeration and elevation of the tide, by means of narrow channels. All these phenomena were fully proved by the present series of observations. The author of this paper also considers it to have been fully established by the observations on the Firth of Forth, that there exists on the eastern coast, satisfactory evidence of the presence of a second tide-wave in that part of the German Ocean, and that the southern tide-wave, a day older than the northern tide-wave, sensibly affects the phenomena of that part of the coast. To this he attributes the double tides of the Firth of Forth, the nature of which he fully explained. Regarding these double tides, various theories had been formed—and there were various ways in which such tides might happen, whenever tide-waves arrive by different paths in different times. But this kind of double tide was, in this case, only to be explained by the method he had adopted, and which removed the difficulties in which the subject had formerly been involved. He then proceeded to explain the mode of discussion which had been adopted. It was the semi-diurnal inequality, so accurately examined by Mr. Whewell, which enabled us to decide on the ages of two tides. If the two tides which appeared together, presented opposite inequalities both in time and in height, regularly alternating, varying with the moon's declination, disappearing with it, and re-appearing with it, and following it regularly, without regard to other simultaneous changes of a different period, then it became plain that no other inference could be drawn, than that which he had mentioned; when, further, he had proceeded to treat these tides as compounded of two successive tides, one due to a transit $12h\ 24m$ later than the other, and had used for this purpose two simple river tides super-imposed at a distance in time corresponding to that at which the northern and southern tides could enter the Firth, he had obtained a close representation of the double tides of the Firth of Forth; when these two methods of examination ended in the same conclusion, he conceived that it had obtained a very high degree of probability. By means of these observations tide-tables had been formed, which were designed to afford a more accurate means of predicting the local tides of the east coast of Scotland than any we now possessed.

Dr. Robinson and the President put several questions to Mr. Russell, for the purpose of eliciting the facts more clearly.

Lord Mountcashel inquired whether Mr. Russell had observed and accounted for any of the tidal phenomena which were denominated bores, and described one which he had witnessed in the river Seine, the rapidity of which far outstripped that of the steam-boat in which they were proceeding.

Mr. Russell said that he had frequently observed this phenomenon, and described the bore of the river Dee, and of the Solway frith. He then briefly accounted for it on the principal of the tidal wave coming with enormous rapidity from deep water, where it was freely propagated into shoal water, where the upper part, retaining its velocity less impaired while the bottom was retarded, it toppled over, at length, breaking in its rapid onward course.

Captain Larcom observed that the ordnance survey would contain a very full account of the tidal phenomena along the coast of Ireland. Captain Larcom hoped before long to lay before the Association the result of the observations made on the coast of Ireland in the course of the ordnance survey. Gauges were established at different stations, and observations have been made every five minutes during the course of three lunations. The direct object of them was to obtain data for the plane of mean sea level; but while the observations (which are now in course of reduction) are likely to decide this, they also give much valuable information as to irregularities like that just mentioned. He might mention that in Lough Swilly the spring tide high water was eight feet higher than in Lough Foyle.

Mr. Hawkins read a paper on the *Friction of Water on Water*, as exemplified in the well-known experiment of emptying a vessel full of water by sending a jet of the fluid through it. This friction of the particles of fluid against each other, caused the principal obstruction to the motion of ships through the water; and he conceived that it would be advantageous to grease the bottoms of ships to diminish the friction.

On the Form of Ships.

Mr. Scott Russell read the "*Report of the Committee on the Form of Ships.*"

The report was voluminous; it contained the reductions of a large number of experiments, and about 20,000 observations, made on more than 100 vessels of different forms; accurate drawings of all of which, on a large working scale, were laid on the table. It was the hope of the committee that this report might be published, in order to give the public all the benefit which accurate knowledge on this point was likely to convey. He did not, therefore, enter fully into the details of these voluminous results, but would confine himself to a general account of the objects which this committee had in view, the methods of inquiry which they had adopted, and a few of the more general conclusions to which they had been led. These experiments had now occupied the attention of the committee during a period of five or six years, and it afforded him peculiar pleasure to be able to present the concluded investigation to this meeting. It was appropriate to this meeting, inasmuch as Cork was an important sea-port, of increasing prosperity, whose interests were involved in everything tending to the improvement of our mercantile navy: it was further appropriate, inasmuch as there existed in the vicinity of Cork a class of the fastest sailing vessels in existence—he meant the fleet of yachts—by the successive trials of which many improvements had been made in the form of vessels; and, indeed, he considered it due to the yacht clubs of this country to say, that much had everywhere been due to their exertions in the improvement of the speed of our ships. He had had the good fortune to find in Cork a gentleman who, in the recesses of his own study, had been carrying on, for many years, valuable scientific investigations on this subject, who had submitted his views to experiment with great success, but had long felt the want of just such a series of researches as he had this day the pleasure of laying on the table. The beautiful models by which the report was illustrated, had been constructed by Dr. Phipps, to whom he had thus alluded; and in Mr. Beamish, also a native of this place, he had found another scientific and successful investigator in the same field of inquiry. On this account he should enter more fully into this subject, as one in which Cork was especially interested. It had long been the reproach of science, that so little had been done to enable the practical man to proceed with certainty in his attempts to improve the speed of ships. There are some points in which science has done all that can be desired. The immersion of a ship, her trim, her centre of buoyancy, her stability, can all be determined, with accuracy, beforehand, and the scientific naval constructor can proceed with certainty upon fixed principles. It is otherwise with the speed and resistance of a ship. In nothing does calculation more completely fail them than in the attempt to determine beforehand the speed of a ship constructed on given lines, or to show how a form may be so altered as to render it faster than before. To calculate the resistance opposed by the water to the passage of a ship through it, and to find that form which, at a given velocity, will pass through the water with least resistance, and, of course, with the smallest expenditure of power—such was the problem hitherto the least solved, and always one of the most important, which these experiments were intended to investigate. There were also two phases in which this problem presented itself, the scientific and the practical view of the subject. There were, therefore, two classes of experiments—one designed to advance our knowledge of the laws of hydrodynamics which govern the phenomena of resistance of fluids, and the other, the experiments serving as a basis to the operations of the practical construction of ships—the *Experimenta lucifera* and the *Experimenta fructifera* of Lord Bacon. To the latter class, he would confine the remarks of to-day, as belonging more especially to section G, the former having been discussed in section A. Many experiments had formerly been made on this subject, but we had, at that time, so imperfect a system of hydrodynamics, that the conclusions drawn from them could not be relied on with confidence by the practical man. The Academy of Sciences had made a series of such experiments at a large expense defrayed by the French government. Colonel Beaufoy, in our own country, had made an important series of such experiments, at an expense of £30,000, but these were of comparatively little value, for the same reason, viz., that the forms did not comprehend such forms as were actually required for the purposes of naval construction, and because the state of science was not such as to enable us, from the resistance of one form, to deduce with certainty that of another. For the purpose of giving practical value to the present series, experiments had been made on many different scales of magnitude, some in narrow channels, others in large canals, and finally on the open sea. Some were made on models 3 ft. in length, others of 10 ft., some on vessels 25 ft. long, 75 ft. long, and some on vessels 200 ft. long, and nearly 2000 tons capacity. Thus it was trusted that the scale of the experiments was such as to give confidence in the results. Next, as regards the forms of vessels made the subject of experiment, these were similar to those required for the practical purposes of construction. One class consisted of such forms as were required for steam navigation. Plans of steam ships of the best construction and others of worse forms, were accurately laid down on the same scale, in the same way, and with the same accuracy of proportion as if they had been for actual service, and along with these were some of new forms. A given form having been found to be a good one, was then varied by lengthening, first in one manner then in another, to discover the best mode of improving a given good form. In sailing vessels, some of the celebrated Chapman's best forms were taken, and treated in a similar manner, and along with them were com-

pared the common forms of merchantmen and other ships. The class of fast-sailing yachts and cutters was treated in the same way, the object always being the determination in given circumstances of the method of giving such a form to a ship as shall enable her to pass through the water with the least resistance, the greatest velocity, and of course the smallest expenditure of force, power, and money. The methods of drawing these vessels through the water, varied with the scale on which the experiments were made. Those on the smallest scale were drawn by a weight arranged in such a manner as to supply a uniform force through any given distance—and on the largest scale, the experiments were made on the sea by means of powerful towing vessels. In this way the experiments were made on a wide range of magnitudes, both as regarded the vessels themselves and the sheet of water on which they were propelled, an element of resistance not always sufficiently taken into account. The resistance was accurately measured by dynamometric apparatus of great accuracy, through which the moving force was communicated to the vessel; the velocity being determined, in certain cases, by a peculiar apparatus designed for this purpose, and in other cases by instruments for measuring and marking time with accuracy. After the observations had been reduced by independent calculators, and not till then, were they made the subject of special examination, with reference to any theory; and thus it was conceived that the greatest amount of authenticity had been secured. The author then proceeded to give to the meeting a number of specimens of the results which the experiments afforded, such as he knew were likely to interest those members of the section who were acquainted with the principles of naval construction. He demonstrated a remarkable law, by which it appears, that each velocity has a corresponding form and dimension peculiar to that velocity; and he showed, in a variety of diagrams, the means of constructing such forms. To show how much influence *form* alone, without any other element or dimension, affects the question of resistance, he adduced the following as one of the most important experiments. Four vessels were taken, having all the same length, the same breadth, the same depth, the same area and form of midship section, and all loaded to the same weight, displacement, and draft of water. The only difference being in the character of the water-lines; No. 1 being of the new form indicated by these experiments as that of least resistance; No. 3 the old form, very nearly the reverse of the first; No. 2 intermediate between them, and No. 4 intermediate between No. 1 and No. 2. The following table shows the result of the comparative trial:—

Speed in miles per hour.	Resistance in pounds.			
	No. 1.	No. 2.	No. 3.	No. 4.
3 miles	10	12	12	11·3
4 ..	18	22	23	21
5 ..	28	38	42	35
6 ..	39	61	72	56
7 ..	52	96	129	84

These differences showed how much might be gained, everything else being equal, by the adoption simply of judicious form in the construction of the water lines of a ship. The vessel No. 1 was constructed on the wave-line; the methods and rules for which he proceeded to explain in diagrams, too numerous for our space to admit. But we hope the speedy publication of the report itself may soon remedy this omission.

Mr. Perry observed that the position of the paddle-wheels in steam vessels was an important subject, which required to be determined, especially as different opinions were entertained by practical men whether the paddles should be nearer to the stern or to the head of the vessel.

The Marquis of Northampton remarked on the importance of these experiments, which had been carried on by the British Association. The results would possibly produce a change in the naval architecture of every country in the world; and if the British Association had done nothing else than carried out these experiments, and attained those important results, all the efforts they had made would have been amply rewarded.

Mr. J. Taylor observed that these experiments had been carried on for five years, and that the late Sir J. Robison, who had been associated with Mr. Russell in their prosecution, had watched over them with great anxiety till within a short period of his death. The Association had expended £850 in making these experiments, and now came the question, what was to be done with the valuable body of information that had been collected? It ought not to lie idle on their shelves, but ought to go forth to the public; and the best manner of accomplishing that would be a subject of consideration for the Council.

Mr. Russell said, that with regard to the position of paddles, the subject had been already taken up by the government, and some practical results might shortly be expected. In conducting the experiments for the British Association, Sir J. Robison and himself having satisfied themselves as to the correctness of their system, they had endeavoured to get it introduced without exciting opposition. The experiments were made in a ship-building country, and ship-builders every now and then borrowed the forms of the boats that had been found to move the fastest through the water, and thus they had been gradually introduced. The *Flambeau*, which was built on the Clyde in 1839, on one of the experimental lines, beat a vessel of greater length, though having but 75 H.P. against 120. In smooth shallow water the vessel on the old construction was a match for the *Flambeau*, but in a deep and heavy sea the experimeutal vessel beat the other by two miles an hour. There had been since constructed in that part of the country a whole class of vessels built of that form. The *Great Britain* had the wave waterline; and the *Vanguard*, which made her passage last week from Dublin to Cork in two hours less time than had ever been previously accomplished, constructed by the same builder who had made the models for the British Association experiments.

Elasticity of Materials.

"*Experiments to prove that all Bodies are in some degree Inelastic, and a Proposed Law for estimating the Deficiency.*" By E. Hodgkinson, F.R.S.

Mr. Hodgkinson said it was a principle generally acknowledged in the present day, and employed by those who have written on the subject of elasticity, that, when bodies are acted upon by forces tending to elongate or compress them in a small degree, the changes produced are in proportion to those forces; and that equal extensions and compressions are produced by equal forces. That this principle is true, so long as the change produced in bodies is very small, is not to be doubted; and as regards *extensions* it is the basis of the early investigations of Jacques Bernouilli on the elastic curve; of Hooke who was its author (Theory of Springs, Phil. Trans., 1666,); Mariotte, Leibnitz (De Resistentia Solidorum, 1684). With respect to elasticity, it was adopted in the profound inquiries of Euler on the strength of columns, which were corroborated by Lagrange (Berlin Memoirs); and with respect both to *extensions* and *compressions*, it forms the basis of the calculations on the strength and elasticity of bodies in the principal theoretical and practical works on mechanics of the present day; as the Mécanique of Poisson, and the works of Whewell, &c.—the practical treatises of Navier, Poncelet, Tredgold, Barlow, Moseley, &c. He hoped, however, to convince the section that this principal does not operate *alone* in the resistance of bodies subjected to tension, or to compression, or to both. He hoped, too, to show the law which the element, not considered by writers, nor generally known to exist, is subject to. This element is a defect of elasticity, or a set, to which all bodies made to undergo a change of form, however small, seem to be liable, The defect here mentioned was known to exist only when the body had been strained with a considerable force, or such as to be equal to one third, or upwards, of the breaking weight. But the experiments which he should adduce would show that the defect commences with the smallest changes of form, and is increased according to the square of the extension, or compression, or of the weight. Thus, if e represent the extension or compression which the strained body had undergone, and $a\,e$ the force which would have produced that extension or compression if the body had been perfectly elastic, the real force necessary to produce this change, e, will be less than the former by a quantity, $b\,e^2$, representing the defect of elasticity. Hence the force required to produce a change, e, is $a\,e - b\,e^2$, where a and b are constant quantities. He had found this law to obtain when the change produced in the body arose from extension or compression alone, but when the change arose both from extension and compression, as in the flexure of a rectangular body, the force of a fibre was to that due to perfect elasticity, as $a\,x - b\,x^2$ to $a\,x$; or it was equal to $a\,x - b\,x^2$ where x was the height applied, and $a\,b$ constant quantities, as before. In proof of these statements, Mr. Hodgkinson mentioned that having remarked, in his experiments made for the British Association on the subject of hot and cold blast iron, that the elasticity of bars broken transversely was injured much earlier than was generally assumed, he paid particular attention to this circumstance in his future experiments, and had bars so formed that he could separate the elasticity of extension from that of compression; by these bars, which were very long and of small depth, he perceived that one-fiftieth or one-eightieth of the breaking weight was sufficient to injure the elasticity. He mentioned the matter to his friend Mr. Fairbairn (who was associated with him in the inquiry), soon after he had made the discovery; and Mr. Fairbairn's subsequent experiments made to determine the strength of rectangular bars of iron, from all parts of the kingdom, were conducted in the same manner as Mr. Hodgkinson's had been; the deflexion and quantity of set, or defect of elasticity, from each weight being always observed. Mr. Fairbairn's experiments were on bars cast one inch square and five feet long, and were made with the utmost care; Mr. Hodgkinson has, therefore, adopted their results with respect to the "set," and taking means both from Mr. Fairbairn's results and his own on the same sort of bars, he has sought for the relation between the weights and the mean sets from those weights, these sets being the deflexions or deviations from the original form of the bar, after the weights have been removed. To ascertain the relation above, Mr. Hodgkinson has curves described from the results of the experiments, making the sets the abscissæ, and the weights the ordinates; and the similarity in appearance of these curves to the common parabola, led him carefully to examine whether they were not in reality represented by that curve. The examination was successful—the parabola was the curve; and the mean results

of the observed sets, together with the calculated ones, from equal additions of weight, from 56 to 448 lb., derived from 44 kinds of cast iron, and from 90 to 100 experiments, were as follows:—

Weights ..	56	112	168	224	280	336	392	448
Mean sets ..	·003	·013	·026	·047	·069	·102	·136	·197
Computed sets parabolic	·003	·012	·027	·047	·072	·102	·138	·181

Mr. Hodgkinson made experiments on stone, timber and wrought iron, and observed the quantity of set in all. These different materials, when the results from them were constructed, all gave the form of the parabola, though less perfectly than in cast iron, as the experiments on them were but few. It appears, from the above-stated experiments, and others that were made, that the sets produced in bodies, are as the squares of the weights applied. Hence, there is no weight, however small, that will not produce a set and permanent change in a body; all bodies, when bent, have the arrangement of their particles altered to the centre; and when bodies, as the axles of railway carriages, are alternately bent, first one way and then the opposite, at every revolution, we may expect that a total change in the arrangement of their particles will ensue. It appears, too, from the results of these experiments, that all calculations hitherto made, on the strength and elasticity of bodies, have been only approximations. Mr. Hodgkinson stated, that he laid the results of this communication before a meeting of the Literary and Philosophical Society of Manchester a short time ago, soon after he had made the discovery which it contains. In the prosecution of the experiments he had received every assistance which the works of his friend, Mr. Fairbairn, could supply; and Mr. Robert Rawson had kindly assisted him in the reduction and arrangement of the results of the experiments.

This communication gave rise to much conversation, in which the President, Prof. Lloyd, Dr. Robinson, and other persons joined, and in which all agreed, that these experimental inquiries were of the utmost importance in supplying a solid foundation for the speculations of the mathematical investigator in this most difficult branch of physical inquiry. Dr. Robinson also inquired, if Mr. Hodgkinson had observed whether the molecular structure of the bodies, on which he had experimented, was altered in any manner, and if so, how did the change take place, during the progress of the experiments? Mr. Hodgkinson replied, that he had no means of determining this point satisfactorily, but he had no doubt, that matter, when subjected to strain, long before it broke, had its molecular structure permanently deranged. He exemplified this by the axles of locomotive engines, which, as they turned round, had the parts that were extended and compressed successively underneath and above; and after this action had been continued for a long period, they were found to become of a kind of crystalline structure, internally, and of course were much impaired in strength.—Prof. Stevelly said, that the forces to which they were subjected were in kind, though not in degree, something like the alternate bending back and forward of a piece of wire under which it at length broke.—Mr. Hodgkinson assented.

"On Changes in the Internal Construction of Metals."

Mr. Lucas, in the absence of Mr. Fairbairn, reported the progress of the Committee appointed at the last meeting, to ascertain experimentally whether any and what changes take place in the internal constitution of metals exposed to continual vibration and concusssion. (The results of these experiments were stated by Mr. Hodgkinson in the last paper).—The effect of concussion on the shafts of tilt hammers is very remarkable. The shafts are made of the best ash, but after three or four months' use the strength of the wood is so much deteriorated that the shafts break off short as if they were rotten. Copper is also similarly affected by concussion, and in working copper articles, and in rolling silvered plates of copper, the workmen find it necessary to anneal the metal to prevent it from breaking.—Mr. J. Taylor observed that this subject had been much discussed at Manchester, and with the same results. He alluded to the difficulty of procuring good chains, and said it occurred to him that probably it might arise from the chain maker being *too good* a workman, and that the evil was caused by too much swaging in finishing the work. If, however, the quality of the iron could be restored by annealing, as might be inferred from these experiments, that would present the means of obtaining good chains in the first instance and of strengthening them after use.

On Contoured Maps, by Captain Larcom.

It is important that maps constructed by the government should exhibit the levels of the country in the most intelligible manner; showing heights not merely on the tops of hills, but round their sides, and through the valleys which traverse them. Such a system is offered by these contours. They are a series of horizontal lines, at a certain distance asunder, and at a certain height above a fixed datum. The datum most commonly used is the level of the sea, doubtless from the shore line being the limit of the land, and the point at which roads must cease, as well as from an impression that it is itself a level line; and therefore, as the first contour, the most appropriate and natural zero, from which to reckon the others. The Section were aware that it has been a point much discussed, whether the high water, the low water, or the mean state of the tide, offers the most level line. This is a point which it would be out of place to discuss here, but it may be stated that, in order to determine it, as far as Ireland is concerned, a series of lines has been very accurately levelled across the island in various directions, and permanent marks are left in all the towns, and on numerous public buildings; and at the end of each of these lines on the coast, tidal observations have been made every five minutes during two complete lunations. These observations, and the connecting lines of level, are now in process of reduction—the degree of accuracy attained is such that a discrepancy of ·2 of an inch is immediately apparent—and from them we may expect many points of interest. The steeper the natural slope of the ground is, the closer together the contours, of course, will be, and the more oblique the road; where, on the contrary, the ground slopes very gently, the contours are further asunder, and the road may be proportionally more direct. By examining the maps of the Irish Survey, on which contours have been drawn, it will be seen that they tell sad tales of the existing roads, every one of which ascends and descends frequently, instead of keeping on a gradual slope for its whole length. In order to exhibit these lines, it is proposed, instead of adding them to the original copperplate, which has a peculiar value as an official record of boundaries, to make a copy of the plate by the electrotype, for the purpose of receiving these lines. Contour maps were thought of early in the progress of the survey, but means were wanting for their execution; at present, however, the outline survey being complete, and the general map, or map of the surface, being in progress, affords a convenient opportunity, which it is hoped will not be lost.

Dr. Robinson inquired of Capt. Larcom whether the process of contouring the maps was proceeding, and how soon he supposed it would be completed for Ireland.—Capt. Larcom replied, that for the present it had been suspended.—Dr. Robinson observed, that whether he considered the value of this process in relation to the general interests of science, or the most important practical economies of the country at large, he could not but deeply deplore the suspension, temporary though he hoped it would be, of this great national undertaking; and he trusted that, before the British Association closed its present sitting, the most energetic steps would be taken to make such an application to government as would induce them to resume this most valuable work. He begged to inquire from Capt. Larcom, what the expense would probably be.—Capt. Larcom replied, that he should estimate it certainly at less than a farthing an acre.—Dr. Robinson: And the original cost was probably sixpence or eightpence.—Capt. Larcom said, perhaps sevenpence to ninepence.—Dr. Robinson: Then, at a cost of about one thirty-second part of the original expense, this invaluable addition to that splendid work, the Trigonometrical Survey of Ireland, could be accomplished. If it was determined finally to suspend this work, he should say that it was very like what the homely adage characterized as penny wise and pound foolish.

"On a Method of ascertaining Inaccessible Distances at Sea or Land."

Mr. P. Leahy read a paper on a method of ascertaining inaccessible distances at sea or land, for which he claimed the advantages of greater accuracy and expedition than by the method of measuring a base line by the log. On his plan two small telescopes are fixed at the greatest distance the vessel will admit of, and so as to form some multiple of ten feet. This distance forms the base line on which the calculations are to be made.—Mr. Macneill being requested by Dr. Scoresby to state his opinion of the invention, the latter said that it was sound in principle, but he thought with so short a base line and with the difficulty of taking simultaneous observations at sea, it would be liable to inaccuracy.

"Formation of Concrete."

Mr. Hawkins made a communication on the formation of Concrete, showing more particularly the importance of having the stones of the proper sizes, so that the smaller ones should as nearly as possible fill up the interstices of the larger. Where the sizes were properly adjusted, he found that one proportion of lime to twenty of shingle, formed a stronger concrete than when larger proportions of lime were used. Some engineers are in the habit of using one of lime to six of shingle, and the proportions generally used are as one to eight. A specimen of concrete made in the proportions he recommended, and with shingles of proper sizes was found after a short time to be stronger than an old Roman wall.—Mr. Macneill said he preferred artificial cement to lime, and he had found great advantage to result from allowing the mass of concrete to fall from a height, by which means the shingle became more compressed together. Mine dust mixed with lime, he believed, made the most perfect concrete.—Mr. Jessop and Mr. Taylor also approved of mine dust. The latter observed, that it was probably from the quantity of iron in mine dust, that its adhesive properties were derived.

"Raising Sunken Vessels."

Sir T. Deane explained the method adopted by his brother, Mr. A. Deane, to raise the *Innisfaile* steam vessel, of 500 tons, which was sunk by striking against an anchor in the Cork river a few years ago. The ordinary methods of raising sunken ships having proved ineffectual, a coffer-dam was made round the vessel in the middle of the river; and pumped dry by means of eight or nine chain pumps. The leak was ascertained by digging under the ship, and a cow hide was nailed over it to keep it water-tight. The coffer-dam was removed as quickly as possible, when the *Innisfaile* again floated by her own buoyancy, and the steam having been got up, she was taken to Passage to undergo the necessary repairs. The whole cost was 400*l.*, and the work was done in the course of four tides.

KYANIZING TIMBER.

ANTI-DRY-ROT COMPANY, (KYAN'S PATENT).

(*An Advertisement.**)

MR. EDITOR—Mr. W. B. Prichard has recently published a letter in several periodicals, in which he expresses astonishment that I should state that both his report and letters are inaccurate, and, because I used so mild a phrase, he has thought proper to make further statements of a like character; I therefore feel it my duty to state and prove, that in some instances he has omitted to state the *whole* truth, and in others he has challenged what is decidedly *untrue*.

He omitted to state that the sleepers that had shown symptoms of decay were prepared, *by way of experiment*, with solution only half the strength required by the patent.

He *stated* that, at Shoreham Harbour, a waling piece, the very heart of English oak, Kyanized, in use only four years, was like honeycomb, completely eaten away by the teredo navalis.

A full board of the commissioners of the harbour, appointed a committee to view, who have reported the Kyanized timber *as sound as when first put in*.

He stated that he had removed the oak waling, and that the decay was below water mark. I annex the certificate of five witnesses, three of them gentlemen of unexceptionable character, and the other two are his own witnesses, who assert that he could not have taken an *oak* waling from below water mark, as those walings are exclusively of *beech*, and that no Kyanized waling has been removed within the last six years; they also report, that after a careful survey they can find no symptoms of decay in any of the piles.

Mr. Prichard has inserted a certificate from Mr. Buckwell and Mr. Butler, in confirmation of his assertion, that the piles are decayed, which I have ascertained was written *before* the inspection took place, and objected to afterwards, and nevertheless published in its original form; how much dependence can be placed on this certificate may be ascertained from the annexed letter, (No. 3.) from the gentlemen who signed it.

Mr. Prichard also inserts a certificate from the workmen at Shoreham Harbour, that they inspected the piles *in the presence* of Mr. Meredith, engineer to the Brighton Railway.

The workmen positively deny that Mr. Meredith did accompany them during the survey.

Mr. Prichard asserts that Lord Manvers has impugned Kyan's process. I am authorised by his lordship to state that "after very extensive experience of its effects, his early impressions in favour of the discovery has been abundantly confirmed," and that he continues to have "unshaken confidence in its efficacy as a preservative of timber of every description."

Mr. Prichard insinuates, that Mr. Brunel, under whose directions immense quantities of timber were Kyanized for the Great Western Railway, is now opposed to our process.

I annex a letter (No. 4) from the engineer's office of the Great Western Railway, from one whose name will well vouch for the truth of the statement, "that after Kyanizing upwards of 40,000 loads of timber he is well satisfied with the result, as after six years' trial, the timber, on every examination, has proved as sound as when first laid down."

Mr. Prichard asks how many hundreds of the sleepers on the Brighton Railway have decayed.

I submitted his question to the chief engineer on that line, and he stated in reply, that he is not aware that one *Kyanized* sleeper is decayed.

Mr. Prichard states, that the opinion he has given about Kyanizing is perfectly disinterested, although he strongly recommends the process belonging to his friend and solicitor.

These statements of Mr. Prichard are so void of truth, that I feel it my duty to expose them, and having done so, am convinced that any further statement Mr. Prichard may make will prove innoxious, and not require any reply from me on behalf of the Company.

2, *Lime Street Square.* TASWELL THOMPSON, *Sec.*
6th Sept., 1843.

LETTERS AND CERTIFICATES ABOVE REFERRED TO.

No. 1.

WE, the undersigned, having at the request of Mr. Taswell Thompson, this day minutely inspected several of the piles of in the east pier of Shoreham Harbour, embracing all those represented to have been Kyanized, and many which have not been subjected to that process, do certify that we find no symptom of decay whatever in any.

We have carefully surveyed the whole of the two lower waling pieces, and find no indication of any of the original having been removed. The material employed for this purpose is beech exclusively.

We further report, that the piles both descriptions, on the east side of the said pier are slightly touched by the worm, just above the sand.

J. B. BALLEY, Ship Builder.
WILLIAM TATE, Timber Merchant.
Shoreham, THOMAS THORNTON, late Harbour Master.
August 22th, 1843.

No. 2.

WE, the undersigned, have worked as carpenters at Shoreham Harbour for the last six years, and well know all the Kyanized wood, and can state positively that not one of the Kyanized walings have been removed since they were first fixed in the pier; and we can also state positively, that the two lower walings are formed alone of beech.

Witness, WM. JINGLE. ROBERT BURT.
Shoreham, WILLIAM RATCLIFF.
August 29th, 1843.

No. 3.

SIR—In reference to the report of our view of the piles of Shoreham Harbour, on the 3rd June last, published by Mr. Prichard, we beg to state that its contents, both surprised and annoyed us, as we did not intend to say that any of the piles referred to are decayed, but requested Mr. Prichard to erase the words "gone through several stages of decay," and state instead, that the unprepared and prepared were in a like state of preservation; and we beg to add, that in giving our opinion, we were led to believe, that the Commissioners of the Harbour had requested us to report upon the condition of two chips of wood submitted to us, and not for the purpose of publishing our report as to the efficacy or non-efficacy of Kyan's Patent: and that we had no means of judging which was the prepared wood and which the unprepared, but deemed Mr. Prichard's word sufficient authority, as he was at that time an officer under the commissioners.

Shoreham, CHAS. DOWLEN BUCKWELL.
August 29th, 1843. GEORGE BUTLER.

MR. TASWELL THOMPSON,
Lime Street Square, London.

No. 4.

Great Western Railway, Engineer's Office.
27, Portland Square, Bristol.

DEAR SIR—I have sent you by the carrier a section from the centre of one of our longitudinal timbers of the permanent way; it was Kyanized and laid on the line about six years ago, and you will perceive it is as sound as the day on which it was first put down; it is not singular, with us but in all my examinations I have found it equally sound. I think this simple fact will be highly interesting to you, and you will not begrudge the expense of the carriage.

I would remark that the pickling having been entirely under my management, I was very particular in having the strength of the solution maintained. Upon first immersion the strength was 1 in 14, at a temperature of 62°, and the time of immersion for seven-inch timber was eight days, during this time the solution was kept at a uniform strength by pumping. In this way I have pickled upwards of 40,000 loads of timber, and the quantity of sublimate consumed comes out at about 1½lb. to the load.

T. THOMPSON, Esq. Your's truly,
August 31st, 1843. J. HAMMOND.

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* We cannot allow this controversy to be continued unless the communications be paid for as Advertisements.—EDITOR.

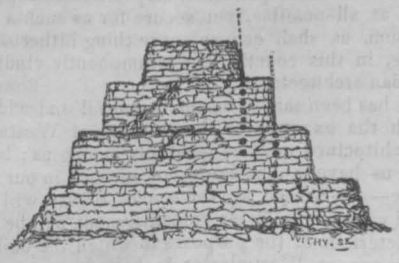
THE PYRAMIDS OF GIZEH.

THE last monthly meeting of the Egyptian Society was very fully attended, as it was announced that Dr. Lepsius would give some description of the researches made by the Prussian Expedition.

Mr. E. W. Lane being unanimously called to the chair, Dr. Lepsius commenced by stating that he felt it to be his duty, whenever he had the opportunity of visiting Cairo, to communicate any information that he might consider interesting to so useful and liberal a Society. He felt assured, from the great progress already made in the few years since its establishment, that it was destined to fill an important place in the history of scientific research in this country. The Doctor then alluded, in proof, to the valuable memoir lately published by the Society, contributed by M. Linant "Sur le Lac Mœris." He offered some observations on the mode of constructing the pyramids, and enumerated the many theories that had been advanced concerning the objects and the construction of these vast monuments. He, however, considered the fact established, that their object was simply to mark the places of tombs, and he then proceeded to explain to the meeting the manner in which they were constructed.

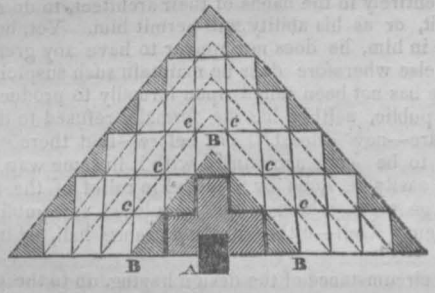
The great pyramids of Gizeh are (in comparison with many others) in a good state of preservation. From the largest, little besides the

casing stones have been removed. In the second pyramid a part of the casing yet remains. In these it is impossible to see the interior construction of the stone work. But some of the small ruined pyramids at Gizeh consist of several steps, each of several courses of stonework in height, instead of the usual form of four sides regularly converging to an apex; and in the more ruined parts of these pyramids it is seen that the steps are formed by walls built against each other, as shown by the dotted lines in the following sketch.



The masonry of the pyramids of Abousir and Saccara is very inferior to that of the pyramids of Gizeh—in all of these the step construction is clearly seen, and also that the steps are separate walls built against each other. The pyramid at Merdoon, again, exhibits this mode of construction. In its present form it rather resembles a huge square tower, the walls of which are slightly inclined, than a pyramid: the outer layers having been mostly removed, the core or central part is left standing alone. In short, in the examination of a great number of pyramids, from Gizeh to the Fayoom, the same mode of construction was found.

To explain a mode of building apparently so contrary to sound masonry, we must suppose a chamber A for the tomb, in or under the



small pyramid B B B, built over it: by filling up the angles of the steps, and adding the fine smooth casing stone, this small pyramid would be completed; but if it were desired to enlarge the work, instead of filling up the angles to prepare for the casing, another step, of the same height and depth as the first, being added to each step of the first-mentioned pyramid, the outline touching the exterior angles of these steps, *c c c*, &c., would be parallel to the outline of the first pyramid; and so on, by continually adding steps of the same section, the pyramid would be increased to any size. The foregoing sketch thus shows five pyramids, one within the other. Dr. Lepsius stated that he was indebted to Mr. J. Wild, architect, for this suggestion, and it agrees with and explains the account given by Herodotus, who states that machines were placed upon the steps, and the stones raised from one step to another. The Doctor then explained, in confirmation of his views, the remarkable pyramid of Dashour; he considered the obtuse angle of the upper part, as the original angle intended. Moreover, Dr. Lepsius observed that this mode of proceeding is in harmony with that adopted by the Egyptians in their tombs excavated in the rock. It is found at Thebes that the first care of the reigning king was to excavate in the rock, and complete and decorate, a chamber for his tomb. If his life continued after the end of this labour, another chamber was added, and then another, and so on; and it is found that the largest tombs are those built by the kings who have reigned the longest. In the same manner, the pyramids may have been continually enlarged during the lifetime of the kings for whom they were intended. All the evidence that remains shows that the largest pyramids were of kings who reigned a long time. It must be remembered, that among the Egyptians it was the duty of the individual to provide a tomb for himself; his successor was immediately occupied upon his own, and thus we find many tombs either hastily or imperfectly finished, and chambers left in all states of progress. Could a monument of such stupendous size as the great pyramid of Gizeh, have been contemplated as an original plan, to have been finished, or nearly so, in the lifetime of one man? but it is easy to conceive that by perpetual additions during a long reign, such a building may have been completed.

Dr. Lepsius then exhibited a selection of beautifully finished drawings of the subjects and inscriptions decorating the tombs round the pyramids of Gizeh and Saccara, architectural plans, sections, &c. The time allowed was too short for more than a slight examination of them. The explanations given of some of the subjects was very interesting.

The Doctor did not refer to his researches in the Fayoom. I am, however, enabled to inform you, that he has fixed satisfactorily the place of the labyrinth near the pyramid of Howarra, and has traced, from what remains, a general plan of it. Its complete ruin is owing to the walls having been built with rude brick, and merely faced with stone; from the same cause, the tombs at Saccara are nearly all destroyed, while those at Gizeh, which are entirely built of stone, are in good preservation.

By the liberal regulations of the Society at whose rooms this lecture was delivered, strangers are permitted to use the library and attend the lectures, if introduced by a member. I had thus the opportunity of hearing the paper I have endeavoured to report to you. The library, although not very large, contains nearly all the valuable works on the antiquities of Egypt and the surrounding countries, the works of the best travellers and historians, some upon Arabic literature, &c.

Dr. Lepsius left Cairo to-day for Upper Egypt.—*Athenæum.*

Cairo, August 17.

ST. GEORGE'S CHAPEL, WINDSOR.

The extensive alterations and embellishments which have been in progress since the early part of May last (from which period the chapel has been closed), at an outlay of several thousands of pounds, throughout the interior of this sacred edifice, having just been brought to a close, the following description of the ornamental and newly emblazoned portions of the chapel of St. George, the curious discoveries made during the progress of the works, and of other objects of interest connected with the late repairs, will, no doubt, be interesting to a numerous portion of our readers.

It is now nearly a century since this chapel had undergone any repairs. At a chapter held by the dean and canons in February last, it was resolved that the chapel should undergo throughout a thorough cleansing and renovation; that new stained glass windows should be introduced in various parts; the organ repaired, ornamented, and many additions made to it; the whole of the elaborate wood carvings and the alabaster and marble monuments in the several private chapels and aisles, restored to their original state; and other embellishments added, so as to render this ancient building one of the most magnificent sacred edifices in the kingdom.

The beautifully groined ceilings of the nave and choir has been thoroughly cleaned by means of immense scaffolding reaching from the floor to the roof; and the whole of the defective parts carefully pointed and restored by experienced workmen. The groined ceilings, also, of the side aisles, chapels, and transepts, have undergone the same careful and extensive renovation, and likewise the organ-loft and that portion of the chapel at the back of the altar. The whole of the whitewash and colouring matter upon the stone pillars, window-jambs, arches, and piers, and upon the hitherto half-hidden Gothic screens to the Hastings, Beaufort, Lincoln, and other chapels, have been removed, restoring the stonework to its rich and varied natural tints, and producing a most beautiful effect. The numerous monuments, and the interiors of the private chapels, belonging to noble and distinguished families, have also been carefully restored.

The whole of the splendid Gothic oaken stalls of the Knights of the Garter (on either side of the choir and those facing the altar) have been cleaned, and repaired where necessary, so as to render them strictly perfect, at an enormous expense. The richly and most elaborately carved canopies over the stalls of the knights (above which are suspended their banners, with their mantles, swords, helmets, and crests, were taken down to undergo a similar renovation and repair. They have also been re-stained and varnished.

The dark and dingy-looking paint which covered the exquisite wood carving of the stalls, has been carefully scraped off, and the wood left in its own tint, which has considerably improved and heightened the general effect of this portion of the interior of the chapel.

It may here be mentioned that on the pedestals of the stalls the life of our Saviour is represented in richly carved work, and on those under the organ-gallery are the adventures of St. George. In 1814

an addition was made to the number of knights, and six new stalls were in consequence added, in front of which are carved representations of the attempt of Margaret Nicholson to assassinate George III.; the procession of the King to St. Paul's on the day of thanksgiving for his recovery, in 1789; the interior of the cathedral on that occasion, and of Queen Charlotte's charity school. On the outside of the upper seat of the stalls, a broad girth, continued round both sides of the chapel, is carved, in Saxon characters, with the 20th psalm, supposed to be intended as a supplication for the sovereign of the Order of the Garter.

The projecting front of the Royal closet (over the north side of the altar, and above the tomb of Edward IV.), which had always been considered to be composed of carved stone, was discovered, upon cleaning off various thick coats of paint and whitewash, to be of carved oak, of a very early date and in a most excellent state of preservation. Such is the rare character of the style of its carving, that there is but one other specimen of its kind in the kingdom, and that is to be found in the Cathedral at Lincoln. The wainscot carved front of Her Majesty's closet has been stained and varnished, and it has now a most pleasing effect as it strikes the spectator upon entering the choir from the west.

The three principal lines of the heraldic bosses on the vaultings of the nave and transepts have been emblazoned with the arms of former Knights of the Garter, and of the most ancient and distinguished families in the empire, and the entire of the bosses, pendants, and knots of the vaulting in the choir have been similarly emblazoned, and in the same rich and gorgeous style, under the immediate superintendence of Willement, of London, to whom the whole of this portion of the embellishments of the chapel, the restoration of the great west window, and the introduction of new windows of stained glass, had been confided by the dean and canons.

A magnificent and highly wrought brass lectern (upwards of six feet high), which had lain in a dilapidated and neglected state, amongst some rubbish, in a vault of the chapel for upwards of a century, and which had been fortunately discovered by the Dean, has undergone a perfect restoration, and now occupies its proper place in nearly the centre of the choir, at the west end of the stone over the vault of Jane Seymour, the Queen of Henry VIII. The top, which is in the form of a double desk, constructed to hold the sacred volume on one side and the Book of Common Prayer on the other, turns round upon a pivot, and from this lectern the lessons will, in future, be read by the minor canon at divine service in the morning and afternoon.

Ten windows (five on either side), of stained glass, containing in compartments the heraldic bearings of all the Knights of the Garter from the institution of the order, have been completed by Mr. Willement on the north and south sides, and at the eastern end of the choir, some portions being over the banners of the Garter Knights. Four other windows (two on either side at the western end) only remain to be similarly emblazoned with the arms of future knights of the order.

A most pleasing and picturesque effect is produced throughout the choir by the introduction of these stained glass windows, which give a rich, yet soft and subdued tone, to the whole of the interior, in perfect harmony with the religious character of the sacred edifice.

The stained glass of the great west window, which may now be classed amongst the most splendid and magnificent in the kingdom, has been carefully and skilfully restored by Mr. Willement, and an entirely new and improved arrangement of the ancient and scriptural figures and devices has been effected under his superintendence. Within the four chief compartments, at the upper part of the spacious arch, are the badges, initials, and crowns of the following sovereigns: Edward III., Edward IV., Henry VIII., and Queen Elizabeth. In the centre of the window are the arms of the patron saint of England, with the initials "S. G." (*Sanctus Georgius*), and at the apex the initials "I. H. S." The whole of the numerous figures contained in the other compartments represent saints, prophets, and apostles; but from the absence, with but very few exceptions, of either emblems or inscriptions, it is difficult to distinguish others than St. Luke, the physician, St. Catherine, St. Dunstan, St. Edmund, St. Edward the Confessor, and St. George.

The general appearance of the sacred edifice, viewed from any one point, is now gorgeous and magnificent in the extreme. The removal of the present wretched specimens of coloured glass in the east window over the altar, and the restoration of its fine tracery and old stained glass, somewhat similar to that at the west end, are nearly all that is now required to render perfect the labour which has been so liberally commenced, and, thus far, so admirably brought to a close.

THE FACADE OF THE BRITISH MUSEUM.

SIR—You may probably be of opinion, that having already called attention more than once to the subject of the British Museum, it is unnecessary to return to it so soon again, more especially as it has since—and, perhaps, *in consequence*—been taken up by other journals. But this last circumstance ought of itself to encourage you not to desist from the good work you have begun, since it must convince you that there exists in other quarters a disposition to support the same views, and, if at all possible, yet secure for us such a façade to our National Museum, as shall eclipse every thing hitherto attempted in the same style, in this country, and triumphantly vindicate the character of Grecian architecture.

A good deal has been said as to the beneficial and widely extended influence which the example of the "Palace of Westminster" will have upon architecture and art generally among us; let it then now be shown: let us have a decisive proof of such in our next greatest national edifice—one where all refinement of art will naturally be looked for, and where even lavish embellishment will be no more than properly characteristic of the purposes to which the building itself is devoted. The one at Westminster is hailed as a very great stride forward in architecture, and as leading to a very much better system of management than has been hitherto observed in regard to our public edifices; are we then now, to step back all at once to our old courses, and to relapse into the apathy we have but just shaken off? Shall we lay the blame, in this instance, on the Trustees of the Museum for their supineness, and their indifference as to what its façade may prove as a piece of architecture, provided there is *house-room* enough within its walls for the various valuable collections deposited in it? Do we yet know if the design has been examined or approved of by them or any one else—Sir Robert Peel, of course, excepted—or has been more than merely assented to as matter of form, without a thought being given to the design itself?

All that can be said at present is, that they appear to have placed themselves entirely in the hands of their architect, to do exactly as he may think fit, or as his ability will permit him. Yet, however they may confide in him, he does not appear to have any great confidence in himself, else wherefore does he maintain such suspicious reserve? It is true, he has not been called upon formally to produce his design, before the public, neither has he formally refused to do so; yet he must be aware—now at least, if not before—that there exists an earnest desire to be made acquainted with it in some way or other—as might very easily be done by a model in relief of the façade, upon rather a large scale, which might be placed for public inspection in the Museum itself—either in the entrance hall, or in one of the galleries.

The very circumstance of the design having, up to the present time, been kept a profound secret, is a strong reason wherefore we should now be plainly informed what it really is; and on an occasion of such high importance, it would be a piece of very false and misplaced delicacy, to refrain from demanding of Sir Robert Smirke to let us see his design beforehand, and judge for ourselves if it be really worthy of being carried into execution, because if not, or is incapable of being rendered so, it had better be laid aside altogether, *coûte qui coûte*, and some more satisfactory one be now prepared in lieu of it, either by himself or some one else.

The façade of the Museum might even now be made the subject of competition: there may, indeed, be no precedent in this country for such course of proceeding, and it might accordingly be considered a strange innovation, but it would at all events be a judicious and safe one. Let a liberal premium—say five hundred guineas—be offered for the best design, on the understanding that that will be the sole emolument derived from it, the carrying it into execution being left to the present architect, unless he should prefer to withdraw himself altogether from the business. Thus, *he* would not suffer pecuniarily, and perhaps less in reputation than he is now likely to do, if allowed to proceed as hitherto, and produce what, when completed, will be found to be a signal failure, and will occasion quite as much public dissatisfaction as Buckingham Palace and the National Gallery. Far more prudent would it be in him to acquiesce, however reluctantly, in what might be construed as a tacit acknowledgment of his incompetency, than to leave a lasting monument of such incompetency behind him.

How do we know, it may be asked, that such will prove the case, when no one as yet knows any thing of the design itself? Justly or unjustly very unfavourable suspicions are entertained, and since no attempt is made to dispel them, by producing the design and convincing us how idle are our fears and apprehensions, it is but natural to conclude that such argument is felt to be a very dangerous one to

resort to, and by no means calculated to secure our admiration for the intended façade.

Surely the Institute might, on such a highly important occasion, exert themselves a little, and stepping a little out of their ordinary course, might venture, in their character as a public body, to *recommend* that satisfactory information should be communicated relative to the completion of the British Museum, and all pains be taken to secure its being completed in such manner as to stamp it a national edifice worthy of the nation and of the name it bears—which it is not likely to prove by many degrees, if we can obtain no more valid security for its excellence than the former productions of the architect to whom it is now blindly confided. No satisfactory pledge for requisite grandeur and beauty in the façade, is afforded by the architecture of the inner court or quadrangle; on the contrary, if the former is not to be of very superior quality and design, it may as well be at once a mere plain and substantial piece of "homespun" building, making no pretensions to any sort of beauty. The subject is one which affords ample scope for the display of imagination and refined taste; and to what purpose, I would ask, are subjects of that poetical class—one so very unlikely there should be any after occasion for, proposed to architectural students at the Academy, if, whenever an actual occasion does occur, nothing better than arrant common-place, and dull humdrum, without even a particle of poetry in it, can be provided. Leaving you and your readers to crack me this question,

I remain,

Yours, and all that,

BRUTUS BRITANNICUS.

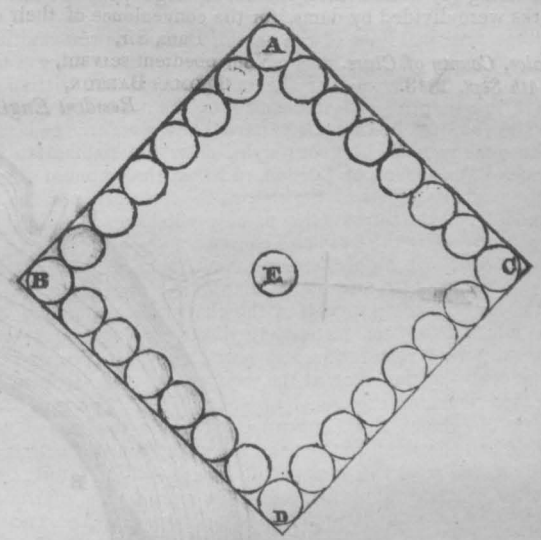
[For inserting the above, in addition to what has already been said in our *Journal* on the same subject, apology is unnecessary. It is one of exceedingly great importance, if not to architects in particular, to architecture and to our national credit in it. Either very much greater importance is attached to the Houses of Parliament and their embellishment than is consistent with public economy, or equal liberality ought to be shown in the case of the British Museum—that is, in regard to what now remains to be done to it. Whether it be now rendered a worthy monument of art, or not, a monument it will be, for ages to come, unless it should happen to be destroyed by fire—a calamity no more to be apprehended for it than for the new edifice at Westminster. The obstinate silence maintained in regard to the design for the façade, is, however, of most evil omen in itself, and bespeaks a determination neither to show, nor to make any appearance of showing, the slightest deference to public opinion, unless upon the extreme compulsion of a general public outcry to that effect. We ourselves have done, and shall continue to do, all we can to force the matter on the attention of our readers, but it is one that ought to be taken up earnestly by the whole of the public press—at least by that portion of it which affects to attend at all to the interests of art. Yet such is not the case at present; for although we do not stand exactly alone, in our anxiety as to the British Museum, there seems to be a strange reluctance on the part of the daily press to bring forward, or even touch upon, the subject in any way. We say "reluctance," because a correspondent informs us that he addressed a letter to the *Times* newspaper, relative to the intended façade of the Museum, but it was neither inserted, nor made use of as a hint for any remarks on the part of that paper.—ED.]

"THE LIGHT FOR ALL NATIONS" LIGHTHOUSE.

SIR—He who builds a lighthouse on the Goodwin sands, builds an imperishable name and a monument to his fame, not only as a skilful and successful architect, but also as the enviable deliverer of thousands, and most probably of tens of thousands, of his fellow creatures from the jaws of destruction. The Goodwin bank, about 10 or 11 miles long from north to south, and between 3 or 4 broad, consists of finely comminuted particles of sand firmly compacted together, offering a great resistance to the introduction of smaller bodies, but quickly entombing ships of burthen which are so unfortunate as to be driven upon them, being, as William Lambert remarks in his "Perambulations of Kent, written in the year 1570, "a most dreadful gulfe and shippe swallouer."

Many years ago the Corporation of the Trinity House formed the design of erecting a lighthouse upon these sands, but the idea was abandoned when, after boring to a very great depth, no solid foundation could be obtained; and since then no determined attempt has been made to build a solid structure until the recent one of Mr. William Bush, whose plan was certainly an excellent one as adapted to sands of known superficial depth; but wholly irreconcileable with the constitution of this particular embankment. Not having these experimental borings of the Trinity House before his eyes, and forgetting the golden maxim "Never to begin a thing until the end is well considered," he launched his caisson in an unknown void, to rest eventually on he knew not what: for although he speaks of a rock bottom, this, at best, is but problematical, and our geological ideas lead us rather to infer that the under soil is analogous to the low coast around Pegwell Bay being intersected with chalk cliffs: be this as it may, it was absolutely necessary to the success of this particular plan, that the exact depth of the quicksand should have been previously ascertained.

For carrying out the plan I am now about to propose, this preliminary step is not necessary, other than in choosing the site upon which to commence operations; and here I am far from thinking that the most elevated portion of the bank is the best for the purpose, from the simple reason that being the apex of the submarine hill, the sands are here most probably the deepest, but I would rather choose that portion of the bank which presents the most precipitous front to the sea, for here it is highly probable the sands rest upon chalk hills or cliffs. The site chosen, let



A B C D, be a given area or superficial square, the angle A being towards the most violent action of the waves: at E, the centre of the square, let a circular well about eight feet in diameter be commenced, the masonry about two feet thick to be firmly cemented together, and so secured as to resist the pressure it must experience as it descends. Commencing at the lowest depth convenient, let the building be rapidly carried on until above high water mark, still continuing it as the lower portion disappears, every means being used to facilitate its descent, should this be requisite. There is little doubt, however, of the building gradually sinking, the increasing weight giving the necessary impetus to its descent, and thus must it continue without reference to the depth, until it meet the consolidated bed on which the quicksands rest: this object attained, the sands are then abstracted from the well, and after the foundations are properly examined the whole is to be filled up with solid masonry.

Having by this central well ascertained the depth of sand, and the nature of the lower bed, proceed to form wells of magnitude and strength proportioned to the depth of sand to be passed through, at points, A, B, C, D, and simultaneously or consecutively the connecting well, as exhibited by the accompanying section, to be filled up in like manner: thus a coffer dam of solid masonry will be formed, from the midst of which the sands, if not very deep, may be abstracted, and solid masonry introduced in lieu thereof, binding the whole as one vast solid foundation capable of supporting a noble edifice.

The idea above given, so far as regards building upon quicksands, is not original, for during my travels in India, my admiration has been more than once excited by vast piles of solid masonry having their foundations within the dry quicksand, a much more difficult undertaking I presume, than building upon the Goodwin Sands, which, from their compactness must offer great opposition to the intrusion of bodies of this nature. The beautiful Scotch Church at Madras may also be quoted as having its foundations laid within the quicksand, being pillared on a great number of wells, as suggested by native architects.

The whole of the wells, and the entire foundation being completed,

immense blocks of stone, contributing to bind the whole together, will then be laid upon it, beginning as far beneath the sand as practicable, and continued full twelve feet above high water mark, and upon this the shaft will be raised, the whole superstructure being left to the skill and taste of the engineer. I have only to add that the expence of the wells, however numerous they may be, will be comparatively trifling, and wholly unworthy consideration, taking into account the vast importance of this truly national undertaking.

M.

ENGINEERING IN IRELAND.

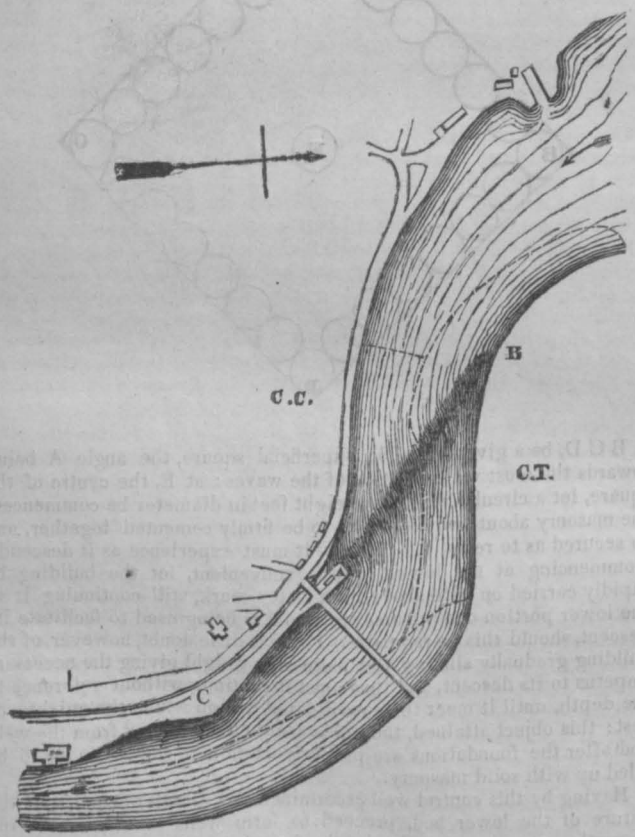
IMPROVEMENT OF THE RIVER SHANNON.

SIR—I shall feel obliged by your inserting the enclosed paper, referring to a portion of the extensive improvements which are in progress in the river Shannon, in the forthcoming number of the *Journal*.

I forward with it a small plan of the site, shewing the weir A. B., and describing (by dotted lines) the three large portions into which the works were divided by dams, for the convenience of their execution.

I am, Sir,

Killaloe, County of Clare. Your obedient servant,
4th Sept. 1843. THOMAS BARTON,
Resident Engineer.



Scale, 800 ft. to an inch.

REFERENCE.

C. C., County of Clare. C. T., County of Tipperary. A. B., The Weir. The bridge which crosses the river leads from Killaloe, county of Clare, to Ballena, county of Tipperary. C, canal.

On Tuesday, 15th August, Lieut. Col. Harry D. Jones, R.E., Shannon Commissioner, and Thomas Rhodes, Esq., principal engineer, accompanied by William Mackenzie, Esq., the contractor for many of the important works on the line of the Shannon, arrived at Killaloe, and on the following day, inspected the works which are in progress in that beautiful neighbourhood, and are fast verging to completion; after which Col. Jones proceeded on his periodical tour of inspection to the works in the Lower Shannon; having previously visited the Scarriff River, where an improvement is carrying on that is likely to be of the utmost advantage to the Towns of Scarriff and Touryvaney, and to a very extensive agricultural district surrounding them.

On Tuesday (22nd ultimo) the gallant Colonel returned to Killaloe for the purpose of witnessing on Wednesday, according to arrangement, the admission of the water to that part of the great regulating weir, which had lately been completed, but Old Shannon, grown impatient, would no longer be held in artificial bonds, and bursting forth, resumed his dominion, sweeping with magnificent and easy flow along the improved level of his bed, and thus anticipated the spectacle intended to have taken place on Wednesday.

In October last, a portion of the weir, on the Clare side of the river, amounting to 600 ft. in length, had been finished, and the water being turned over it, dams were made, and the Tipperary side of the river was laid dry for the purpose of reducing the shoal, and constructing the remaining portion of the weir, during which operations the river had been confined to a channel of one half its usual capacity.

The Shannon, at Killaloe, now flows over a line of weir 1100 ft. in length, and it is anticipated that this erection will effect a very considerable permanent reduction of the winter flood, and solve the problem (somewhat difficult to be understood by persons not conversant with the laws of fluids in motion, but which is clearly appreciated by the hydraulic engineer), that a *Bar* or *Weir* may be constructed across a river in such a manner as to obtain an increased discharge.

There is in the apex at the weir, a small deviation of level at one period, so formed as to assist in the annual migration of the salmon, a deep pool being constructed at the foot of the weir, opposite this point, for the purpose of facilitating the leaping of the fish, and at the termination where the weir adjoins to the rock on the Tipperary side, there is a roughly formed inclined plane, by which the young eels, spawned in the estuary, will be enabled to climb the summit of the weir, and pass into the upper waters.

Leaving the question of navigation untouched, some notion may be formed of the improvement likely to result with reference to drainage only, when it is stated that the maximum height of floods at Killaloe, have been known to attain to 9 ft. above the level of the apex of this weir, and that hereafter their utmost height will scarcely surpass three feet above the same datum.

It must be a source of peculiar gratification to Mr. Rhodes, the commissioners' principal engineer, to see, after years of unceasing study and anxiety, that his arrangements are attaining completeness, and evincing success such as could only follow the workings of a genius like his, so particularly fitted to this abstruse branch of the profession, and of which Lord Stanley, (then the Rt. Hon. E. G. S. Stanley) seems to have been so well aware, when, in 1831, he directed this eminent gentleman's attention to *The Shannon! our own Shannon!* the dominant stream of Ireland, and the pride of British rivers!

T. B.

REVIEWS.

Illustrations of the Croton Aqueduct. By J. B. TOWER, of the Engineer Department, (U. S.) Wiley and Putnam, New York and London, 1843.

We have here an elaborate memoir of one of the greatest works of our Anglo-American brethren, a work entailing an expence of upwards of a million sterling, and of that colossal character as to take a high rank among the triumphs of engineering science. It is one of those works which the people of English race on both sides of the Atlantic can look upon with equal pride. We have no doubt that the elaborate and extensively illustrated volume of Mr. Tower will be acquired by many of our readers no less as a record of the Croton aqueduct, than of the high standing which the engineering profession has taken in America, and of the way in which its reputation is mentioned. To do adequate justice to it, it would be necessary to give several illustrations, and we hope at some future time to be able to do this. We make the following extract, to show the reason why the aqueduct form was adopted.

"Having fixed upon the Croton River as a stream possessing the requisite advantages for a supply, questions naturally arose as to the manner in which it should be conveyed to the city. The distance being about forty miles, over a country extremely broken and uneven, and following a direction for a portion of this distance, parallel with the Hudson River, encountering the streams which empty into it and form deep valleys in their courses. It will be interesting to notice the different plans which were suggested for forming a channel-way to conduct the water. The following modes were presented: —a plain channel formed of earth, like the ordinary construction of a canal feeder:—an open channel, protected against the action of the current by masonry:—an arched culvert or conduit, composed essentially of masonry;

and iron pipes. In deciding which of these modes should be adopted, it was necessary to make a comparsion among them as to their efficiency for conducting the water in purity, and in the quantity required, their permanency as structures, and their cost.

"The disadvantages attendant upon an open canal were, that by filtration through the banks there would be a heavy loss of water;—the difficulty of preserving the water from receiving the wash of the country, and preventing injurious matter from being thrown into it and rendering it impure, and the impurities which might be contracted by passing through different earths. Evaporation would also occasion a serious loss of water. The banks would be liable to failure in seasons of long-continued rains, and the city depending upon this for a supply, would be cut off, except there should be sufficient in the reservoirs to furnish a supply during the period of repairs. The canal could never be subjected to a *thorough* repair, because of the necessity of keeping it in a condition for furnishing water constantly during the whole year, so that all repairs would be done under great disadvantages, and the channel would be yearly growing worse until its failure might become a public calamity. In regard to the open channel having the sides protected by masonry, the objections were found to be such as would apply equally to every species of open channel; namely, that it would be exposed in many situations to receive the wash of the country; that it would be unprotected from the frost, and liable to be interrupted thereby, and lastly, that there would be a loss by evaporation. It was supposed that these objections might be obviated by certain precautions; for example, the wash could be avoided by making sufficient side drains; and the interruption liable to occur from frost and snow, and the evaporation to a certain extent, could be prevented by closing the channel entirely with a roof over the top. The close channel or culvert, composed essentially of masonry, seemed to possess all the requisite advantages for conducting the water in a pure state and keeping it beyond the influence of frost or any interruption which would be liable to occur to an open channel. In point of stability this plan had a decided preference over either of the other plans proposed, and the only objection offered was the cost of the work constructed in this way. To avoid too great expense it was proposed to make use of a mixed construction, using the close channel or culvert in situations where deep excavations occurred, and it would be desirable to fill in the earth again to the natural form, also where the line of aqueduct intersected villages, and using the open channel with slope walls for the residue of the distance.

"In regard to iron pipes for conducting the water, it was found that a sufficient number of them to give the same sectional area as would be adopted by either of the other plans would be more expensive, and considering the great distance and the undulating surface over which they would extend, other disadvantages were presented which added to the objections, and the plan was considered inexpedient. Could a line be graded so as to give a regular inclination from the Fountain Reservoir to one at the city, then the expense of laying iron pipes for conducting the proposed quantity of water, would be greater than for constructing a channel-way of masonry; and when laid, the pipes were thought to be less durable. Should the pipes follow the natural undulations of the ground, there would be so much resistance offered to the flow of water that the discharge would be diminished in a very great degree.

The close channel or conduit of masonry was adopted as the plan best calculated to answer all the purposes of conducting the water to the city.

We should like the managers of the New River to read this, and see if they could not take a lesson from it with regard to their receptacle for dead dogs, ditch-water, and diseased bathers, with which they supply the metropolis with pure water. The sooner that concern is covered over the better, the more creditable will it be to the managers, and the more acceptable to the community.

Illustrations of Indian Architecture from the Muhammadan Conquest downwards, selected from a portfolio of architectural drawings, from buildings at Agra, Delhi, Juanpur, Benares Chunar, and numerous other places. By MARKHAM KITTOE, Esq. (Parts 9 to 17, containing 21 plates.) Calcutta: W. Thacker and Co., 1838.

To us it affords great gratification to receive these new fruits of Mr. Kittoe's labours, whether we consider them as the productions of a gentleman of great taste and mental culture, or whether we contemplate them with regard to their architectural influence. If there are still those who doubt that no new resources exist for art but in the plagiarism and piracy of Greek design, let them examine these drawings, and see how oriental artists have availed themselves of the wide range of natural objects, cultivated by every real school of art, and neglected by us alone. The Greek, the Roman, the medieval architect, the Moor, was perpetually engaged in the delineation of new forms and the re-adaptation of well-known objects, while we, whenever we tread in the path of antiquity, find nature, as it were, withering beneath our fingers, and presenting no resource but the reproductions of used-up studies. We have protested against such want of industry and want of genius, against such mawkish and thievish degradation of art; and we are glad to be reinforced by arguments so practical as those which are afforded in the works of Mr. Kittoe. If our reader be a lover of the classic or of the pointed style, he will find in the numbers before us numerous beautiful studies from nature, which he may examine with profit. In fact, were several of the plates of the present work laid before the connoisseur, he would be tempted to refer their subjects to the buildings of Athens, or the internal decorations of Pompeii, rather than to the far East. There are candelabra, tombs, arabesques, to which our associations would allow no other birth-place than the Pelasgic lands. On the other hand, there are corbels, brackets, and ceilings, in which we can retrace every lineament of the pointed styles. There is a great west window, which we might think of European origin. If we want to be convinced that art is catholic, and catholic because she must look everywhere to the beauties of nature for her inspirations, we find ample proofs in these records of the labours of those far removed from European sympathies and European studies. We cannot, however, bring ourselves to believe that the monuments of classic genius to be found in western Asia, have been unstudied by oriental architects, and on the contrary, we are inclined to look here for another proof of the vitality of Hellenic principles. We do not believe that those who doted on the labours of Aristotle, and who preserved and reproduced the literary and scientific monuments of Greece, at the same time that they actively cultivated the liberal arts, could have been unimpressed by the material monuments or Greek genius, which were within their reach. We know that bigotry prevented many of the Mahometan literati, the geographers particularly, from availing themselves of contemporary information; but that certainly did not operate with the mass of enlightened and educated men, who showed every disposition to profit by those labours of the Giaours which were within their reach. We therefore believe that the architecture of the Moors was no more without the impress of Greek influence than was their science, and what we have seen in their various monuments tends to confirm us in those views. To the antiquary and to the student of art we therefore recommend these engravings of Mr. Kittoe, for we cannot but believe that it must act as an encouragement to exertion, when it is seen how much has been done by those labouring under less advantages, and possessing less cultivation. Although the monuments described in those parts are principally of the Muhomedan period, yet they abound in features of interest, and Mr. Kittoe is particularly useful in giving numerous examples of details. In one or two of the plates will be found ingenious combinations of the dome and the pyramid or spire, producing a novel and striking effect.

In conclusion, we leave the work to the study of our readers, with an expression of our obligations to Mr. Kittoe for this employment of Indian residence. We sincerely hope that these labours will be continued, and that he will find his exertions have not been fruitless in calling attention to the state of the fine arts in our vast and neglected Indian empire.

Black's Picturesque Tourist and Road Book of England and Wales. Edinburgh: Adam and Charles Black, 1843.

This is an attempt to bring the old road book up to the pitch of modern improvement, and we are bound to pronounce it successful. It is cheap and portable, at the same time that it contains an immense mass of information, closely compressed, and well printed, illustrated with numerous maps and copper-plate engravings. The letter-press appears to be well executed, as are the maps, with the exception of the general map, which is so much neglected, that we feel it our duty to call Messrs. Black's attention to it, as we presume they cannot be aware of its condition, having bestowed so much care and expence in every other department, and maintaining as they do a reputation so high for accuracy and research. We should not, perhaps, complain so much that the Northern and Eastern, and Eastern Counties Railways are left in their original proportions uncurtailed, we might have passed over the omission of all the recent additions to the railway system, the Hertford and Ware, Peterborough, Warwick and Leamington, Oxford and Maidstone branches, but we are sorry to find such numerous and serious omissions as those of the Manchester and Birmingham, Chester and Crew, Chester and Birkenhead, Bristol and Glo'ster, Llanelly, Taff Vale, Gosport, Hayle, and Canterbury and Whitstable Railways, all of which, with one exception, have been some time in operation, and which are to be found in the district maps of this same work. We are further induced to make this complaint from the negligent way in which railway maps, and maps generally, are produced.

The "Prince of Wales" Iron Steam Vessel. Built by Messrs. Miller and Ravenhill, Blackwall.

People are not generally fond of recording misfortunes and mishaps, though such a record would often be productive of great public advantage in preventing the recurrence of such events. Messrs. Miller and Ravenhill know, however, how to make the best of everything, and they have in a lithograph given us a representation of the "Prince of Wales" iron steamer, in a most perilous position.

"The vessel is entirely of iron, and is intended for the Margate station; she is 180 ft. long between the perpendiculars: in launching, the cleets on the bow gave way, in consequence of the bolts breaking, and let the vessel down, so that the bilge came in contact with the wharf; she was ultimately forced off by screw jacks and two tug vessels, cutting her away deeper into the concrete and planking of the wharf, until she assumed the position represented in the drawing, and at that period the distance measured from the face of the wharf to the point of contact of the vessel and the surface of the water was 110 ft.; the whole of the deck in the centre of the vessel was left unfastened for the reception of the machinery; when completely afloat, it was found that the shear of the vessel was not broken, and that she had received no injury except that the bow was twisted in consequence of letting go the stern rope, and thus exposing the vessel to the sweep of a strong ebb tide. On examination it was found that three of the angle iron ribs or frames were broken, and one of the plates cracked, occasioning a considerable leak, which was accompanied by no other inconvenience than that of filling the bow compartment as far as the first bulkhead; and after hauling the vessel into dock, the necessary repairs were effected in four days."

This shows what iron steamers can do, and we feel indebted to Messrs. Miller and Ravenhill for giving us this record of an occurrence which only served to test the powers of the vessel in question, and to prove the care with which they had provided for its future efficiency.

The Locomotive Engine, illustrated on stone. By JAMES BASIRE. Jun. London: George Hebert.

The designer of these plates has been impressed with the necessity of a better popular acquaintance with the locomotive engine, now that it has become, as it were, a material institution of the country. He has consequently brought forward the present work, which consists of four lithographs drawn in chalk upon a bold scale, representing the external and internal structure of the engine in every detail. We only wish the letter-press had been more copious; however, it will be an acceptable work to those for whom it is intended.

View of the Parish Church of the Holy Trinity, with its proposed Improvements, now in progress. By JOHN BLORE, Architect.

This is a beautiful lithograph by Hawkins, and printed by Day and Haghe, in light and shade; the improvements have been judiciously introduced, and will add considerably to the beauty of the church; we could wish to see similar additions to more of our modern cheap-built churches, in which they are much wanted.

OLD LONDON WALL.—We are glad to be able to state that, in consequence of Mr. G. Godwin's representation to the Institute of Architects, and a letter which that gentleman afterwards published in this *Journal*, a memorial signed by Mr. Hudson Gurney, Lord Mahon, Sir Henry Ellis, and other office bearers of the Society of Antiquarians, and by Mr. Donaldson, Mr. Poynter, and Mr. Bailey on the part of the Institute, was presented to the Society for promoting the building of churches in the metropolis; and that on the motion of Sir R. H. Inglis, it was resolved that the wall should be *preserved entire.*

IMPROVED DRAWING SCALES.—Mr. J. Smith, lecturer and teacher of perspective, has prepared for the use of the profession drawing scales, formed in box and ivory, of very superior workmanship, and at an unusually low price, when compared with those in common use. They are divided with great accuracy, and although several scales are upon some of them, there is not that confusion in the figures too often witnessed. No. 1 and 4, are arranged for architects; No. 2 and 5, for land surveyors and civil and military engineers; and No. 3, is expressly prepared so as to simplify the practice of isometrical perspective, a system of drawing which ought to be in more general use than it is at present.

IMPROVEMENTS ON BROMIELAW HARBOUR AND RIVER CLYDE.

THE following interesting description of the works that have been executed on the River Clyde, and for which we are indebted to the *Glasgow Herald*, shows what continuous exertions directed in the right way will do in effecting improvements of rivers, there are several of our most important ports which might be equally improved, now being silted up, and which in a few years will be almost useless as harbours.

"We are delighted," says the Glasgow Herald, "to observe the rapid progress made the last two months in the works which have been for a considerable time in operation for the improvement of the harbour at the Broomielaw, and which, when completed, will most amply supply the wants of the Glasgow trade for years to come. The works upon which the Clyde Trustees, by means of their able engineer, have of late been bestowing their principle attention are—first, the new harbour below Napier's Dock; second, the new timber and small craft wharf, between the Glasgow and the Accommodation Bridges; third, the additional timber wharf at the Glasgow Bridge for river steamers; and, fourth, the cutting of a new deep channel through the Port-Glasgow bank. Having seen the state of the works so recently as Saturday last, (Sept. 16) we should say that all of them will be finished within a week or ten days from this day, and some of them finished, too, in a manner so massive and substantial, that they promise to resist the action of the elements, and the wear and tear incident to the operations of commerce, for ages to come. The accommodation within the harbour will then stand as follows:—

	Feet.
"Length of quay walls on the north side of the harbour	3700
Length of quay walls on the south side of the harbour	2300
The new quay in the course of formation on the north side, below Napier's dock	550
The new timber wharf in the course of formation on the north side, between the bridges	530
Total accommodation at the Bromielaw ..	7050

In addition to this a ruble dyke has been formed on the river-side ground recently acquired below Todd's mill; which, by the excavations made, has added a space of 100 ft. to the breadth of the river for 800 ft. downwards, and from which 25,000 cubic yards of earth have been removed in the course of the excavations. This, it may be observed, is only the commencement of a series of operations which will eventually have the effect of widening the harbour from 160 ft. (its present breadth at the Kinning-house Burn) to as near as may be 400 feet throughout. The excavations at this spot have already extended to nearly low water line; but in due course it will be further operated on and deepened until there is at least 12 ft. below low water line, which at high water, in ordinary tides, will at all times afford from 19 to 20 feet in the harbour. In addition there is the basin at Bowling, 10 miles below the Broomielaw, which is employed for the laying up of large ships and steamers during the winter months. The basin contains an area of 14 acres. The extension of the harbour between the bridges for small craft is generally looked upon with much satisfaction. It has been long battled for, and is now effected.

"The weir which so long obstructed the navigation at the Glasgow Bridge has now been as near as may be removed, and a new weir has been placed down at the Stockwell Bridge for the maintenance of the top level of the river for the purposes of the Water Company at Dalmarnock. The removal of the old weir has been very rapidly effected, considering that 15,000 cubic yards of stone and earth have been carried away, and from 500 to 600 piles drawn. The depth of water already obtained between the Bridges at full tide is 11 ft., and now that the weir is nearly removed, it will afford accommodation for timber rafts, and all the small craft of whatever tonnage. It is not unlikely, therefore, that the time is not far distant when the river steamers will be provided with tumbling funnels, as upon the Thames and the small craft with folding masts, so that the benefits of steam navigation and of commerce may be brought almost to the heart of the city.

"The operations during the last and present summer, in cutting a channel through the long obstructing Port-Glasgow bank, have been of the utmost importance to the navigation of the river. The cut formed by the dredging machines extends to about 700 yards in length, by 400 feet in breadth, and the result is, that while there is now a depth of 12 ft. of water at low tides, there is no less than 22ft. 6 in. at high water in spring tides. Last year not fewer than 90,000 cubic yards of stuff were excavated in making the cut through the bank, and this season the excavations amount to 70,000 cubic yards, giving a total of 160,000. When it is remembered that this bank was one of the greatest obstructions in the river, and that there have been sometimes from 10 to 15 vessels lying aground on it, we cannot too heartily rejoice at its removal. Since last summer there has not, so far as we know, been a single vessel impeded in its course in sailing over or through the new channel: and when we mention, that this season the Commodore, a large ship in the American trade, sailed up the Clyde to the Broomielaw, drawing 17 ft. 9 in. water, it will give one instance, out of many, of the length to which the capabilities of our river now extend. In addition to the benefits which will be derived from the cut in the Port-Glasgow bank itself, it will vastly facilitate the navigation of the river in other respects, permitting the

upward passage of a vastly additional quantity of tidal flow. We cannot conclude these remarks without bearing our warm testimony to the liberality and enterprise of the members of the River Trust, who have directed, and the ability of Mr. Bald, their engineer, who has planned and executed, these stupendous works, and when we consider that within a comparatively recent number of years, more than half a million of money has been sunk in these operations, and that the revenue varies from £42,000 to £47,000 per annum, we may well say that there is scarcely a similar instance on record of such vast enterprise and such rapid advancement."

ORDNANCE SURVEY.

We are not of those who entertain prejudices against or for the Royal Engineers or any other class, we are staunch supporters of that eminent body, when engaged in the discharge of their legitimate duties, but we could not have been so many years employed in watching the interests of both military and civil engineers, without seeing that a very general attempt has been made to introduce the government officers as competitors with their civil brethren. Government no more wants an exclusive corps of civil engineers than it wants an exclusive corps of architects or lawyers; but as a matter of economy, it is of course right that it should avail itself of the services of the military officers at its disposal for its own works. It is, however, quite clear as a settled principle of political economy that it is most dangerous for a government to meddle at all with the general market of labour. When a corps of officers is kept up at the national expense greater than is required for the discharge of military duties, and work has not only to be made for them, and to be made at the expense of private professional parties, it becomes a great grievance. The want of adequate responsibility of the royal engineers, and the evils attendant upon their employment where they are not required, is well shown in the following letter; and it must be obvious to every man of common sense that their employment in the Ordnance Survey, of England, Ireland or London, must have the same ultimate effect, upon the members of the engineering profession, as the employment of paupers from workhouses to ruin the existence of the poor sempstresses and shirtmakers, about which so much outcry has been made. At the present moment there is a greater dearth of employment in the engineering profession and its subsidiaries than at any former period; and when a legitimate occasion for occupation occurs it is to be given to men who have no impulse to adequate exertion, and no pecuniary penalty to check their errors or their ignorance. We say with the writer, that this state of affairs claims redress.

TO THE RIGHT HONOURABLE SIR R. PEEL, BART.

Sir—It appears by the Parliamentary reports in the newspapers, that you have moved for leave to bring in a bill relative to a survey and the construction of maps, on a large scale, of the city of London: I trust it will not be deemed an impertinent intrusion on my part to make a few observations in connexion with this undertaking.

It has not yet been formally declared who the parties are that will be entrusted with the execution of this important work; conjecture, however, has awarded it to the Royal Engineers, acting nominally under the Board of Ordnance. I have watched the proceedings of these men for years with a lively interest; early associations have, in some measure, excited that interest and kept it alive. Being intimately acquainted with their modes of operation, and enabled thereby to form correct conclusions relative to their value as practical men, I now come forward to deprecate the measure which would entrust to them the survey of the city of London, and to contend for the propriety of its being left open to competition.

You, doubtless, will be furnished with an estimate of the time and expenses necessary for the execution of this work. I can readily believe that if estimates were the data which would determine your choice of parties, the Royal Engineers would at once crush the pretensions of all competitors; but permit me to ask, have the estimates heretofore made by the Royal Engineers, relative to works of this nature, proved correct? It is most notorious that they have not. You are aware that the survey of Ireland has been executed by these persons; this undertaking was commenced in 1824, the estimated time for its completion being seven years, and the estimated expense £300,000; did subsequent experience prove the truth of this? No, it proved its utter fallacy; you, perhaps, will be surprised to hear, that far from bearing out the previous estimate, the scientific operations of these seven years were almost, if not entirely, useless; the maps and other documents proved so grossly incorrect—so utterly unfit for the purpose for which they were designed, that the greater part of them were ordered to be destroyed. Thus, Sir, and for these reasons were the materials which bore the impress of the concentrated talent of five captains and twenty-five lieutenants of the Royal Engineers, for a period of seven years, reduced to their primitive elements: the survey of the island was not completed till 1842, and it incurred an expense little short of three quarters of a million sterling.

But a specious objection may here be started—It may be said that the above would be unfair premises whence to draw conclusions relative to the *present* claims of the Royal Engineers, inasmuch as they were at the time alluded to comparatively inexperienced. I shall not wait to discuss the merits of this plea, but I shall meet the objection on its own ground. In 1841, an act was passed for the survey of the six northern counties of England, the estimated time for its execution being six years; two years of this time have already elapsed, and there is not one county finished yet. The expense, up to the present time, is about £120,000, or £60,000 a year; the quantity surveyed at present amounts to about 2,000,000 acres, and before the mapping and calculation of this will be finished, three years will have expired. We are here furnished with data to find the expense of this survey, and the time of its completion. The contents of the six northern counties are,—

Northumberland	1,197,440	acres
Cumberland	974,720	,,
Westmoreland	487,680	,,
Lancashire	1,130,240	,,
Durham	702,080	,,
York	3,835,040	,,
Total ..	8,327,200	acres.

Then, by a plain statement in the rule of three, if 2,000,000 acres require three years for its completion, 8,237,200 acres will require about twelve years. So that though the Act contemplates that this survey will be finished in 1846-7, it will not be completed till 1853, and will incur an expense of £700,000.

You may now judge, Sir, what effect the experience of the Royal Engineers has upon their estimates. And will you, Sir, permit the continuance of such an expensive system at a period of such financial embarrassment as the present? Let an examination be made before the House of Commons into the past history of the Ordnance survey of Ireland, and the history of the Ordnance survey of England, which is at present in a state of progress—let persons be examined who will give plain facts as to the progress of the work and the outlay of public money—let some of the most intelligent of the Royal Sappers and Miners, and assistants, be examined before the House, and afterwards you can judge of the propriety of entrusting to the Royal Engineers the survey of London. Captain Boldero's reply to a question lately asked by Lord H. Vane, proves that there exists on the part of the Government gross misconception relative to the present state of the survey of the six northern counties. The proceedings of the Royal Engineers have ever been mysterious; in 1835, an Honourable Member moved for an examination into the state of the Ordnance survey of Ireland, but Sir H. Vivian assured the Honourable Member that the work was getting on rapidly, and that an examination would only cause dispirit. When this assurance was given the Ordnance surveyors were plodding their weary way over a district, the survey of which had been previously executed so incorrectly as to need a complete revision.

Since their arrival in England the Royal Engineers have adopted a line of conduct which strikes at the very vitals of a respectable profession—they have entered into a most unfair competition with the civil surveyors of England; I refer to their contracting for the surveying of townships for tithe commutation, their estimates of which work are so low as to wither in the breast of the civil surveyor every hope of successful competition. But, Sir, in point of accuracy, they may be ranked with the other estimates spoken of—they are utterly false. I challenge contradiction when I assert that the *actual* expense of the tithe plans executed by the Royal Engineers is far beyond the *estimated* expense, *so that the public service must suffer from such undertakings.*

Now, Sir, contrast the case of these men with that of a body of civil surveyors similarly circumstanced: the latter have a professional character at stake—the former need not rely on theirs. The Royal Engineers may calculate on their salaries, maugre all their blunderings—the civil surveyors have no such prop. The Royal Engineers have a ready salvo for each mistake—the public purse is their panacea—the civil surveyors have nothing but their talents to bear them out, and a single error such as those which are so common with the Royal Engineers would injure their professional character for ever.

These, then, Sir, are the grounds on which I contend for the survey of London being left open to competition. I am satisfied that the civil profession are able to do it as correctly, as quickly, and more cheaply than the Royal Engineers. Let engineers and surveyors put in tenders for certain sections of the metropolis, all to be executed on a uniform system;—let all parties be bound to a certain time;—let the Ordnance surveyors put in their tenders also, but let them stand on their own merits—let them have no funds to fall back on as heretofore, in case of failure; let their own pecuniary loss be the result of any error in their estimates, and the issue will prove that the civil profession are able successfully to compete with them.

I would not have you infer from what I have stated that the Ordnance survey is altogether wanting in point of talent; I am free to admit that there are many intelligent, respectable men connected with it; but I do contend that the treatment which these men receive is sufficient to wither all their energies. It has been the boast of individuals in high places, that they can procure the best draftsmen in Europe at the rate of 2*s.* 6*d.* and 3*s.* a-day. I willingly admit that, at the present moment, there are first-rate draftsmen on the Ordnance survey, who are condemned to toil for this miserable pittance; but does not the individual "glory in his shame" who would thus make a boast of his ability to crush merit? and I appeal to you, Sir Robert, what interest will a man of talent take in that situation, the pecuniary emoluments of which amount to no more than 2*s.* 6*d.* or 3*s.* a-day, and even that much lessened by travelling and other expenses incidental to the emigrating life of the operative Ordnance surveyor? I could abundantly prove the fallacy of a system of economy which would treat deserving men thus; and I could show that the best, and ultimately the *cheapest*, mode of proceeding would be, to make a situation on the Ordnance survey worth holding, to pay the man of merit properly, and thus excite in him an interest in the work entrusted to him for execution.

Another clog on the proceedings of the survey is the employment of persons at a still lower rate of pay than the above, several of whom are utterly unfit to take any part in the undertaking; the great majority of those employed belong to this class, and their misery beggars description. If the limits of a letter would permit me, I could detail to you the sufferings of numbers of unfortunate Irishmen, who, after having been lured from their homes by an *ignis fatuus* hope, have been dismissed without a fault from their employment, and thrown upon the world houseless and pennyless, in a country whose sympathies often run counter to the name of Irishman. I could show you the quondam Ordnance surveyor craving at the Workhouse door for a morsel of bread, and more than once repulsed as an impostor. I could show you the faithful servant of the survey toiling along a miry road on public business, on a fearful night in December, the rain and snow beating in his teeth, until, overpowered with toil, he sinks and dies, while his lifeless body, instead of receiving decent interment, is thrown like a cumbersome clod into the grave, at the expense of the parish in which he lost his life!

I know there are persons whose interest it would be to damn the credibility of what, in their parlance, will doubtless be dubbed "an anonymous scribbler;" but with reference to such I have to say, let them contradict me if they can. Why, I would ask, is there not a single Englishman employed on the Ordnance survey?—because he would spurn the paltry meed which the rulers of the survey would offer for his services. The Ordnance surveyors are, to a man, natives of Ireland. I have before stated there are many men of talent to be found among them, but the most unfair advantage has been taken, both of the peculiar circumstances of these men, and those of their country.

It may be thought that I have wandered from the proper topic in the course of this letter—that I have forgotten the subject with which I commenced; but this, Sir, is not the case. The revealing, though partially, of the machinery of the Ordnance survey, and the treatment which those employed on it receive, at the hands of their lords and masters, will, I trust, strengthen the credit of what I have before stated—"*That the civil profession are able to execute the survey of London as quickly, as correctly, and more cheaply, than the Royal Engineers*;" and that, therefore, the work should be left open to competition.

SPECTATOR.

Dublin, August 15, 1843.

ELECTION OF CITY SURVEYOR.—A Court of Common Council was held on the 19th of September for the purpose of electing a clerk of the works, in the room of Mr. Montague, deceased, when Mr. Bunning was chosen by a majority over Mr. Young, who had been several years principal clerk in Mr. Montague's office, of 38 votes. The numbers were—

For Mr. Bunning	106
For Mr. Young	68

STEAM PLOUGH ON LOCHAR MOSS.—Lately Mr. Curtis, the eminent engineer, invited about 20 of his friends to witness the machinery connected with this plough put in motion; and it was truly astonishing to see such an immense fabric travel with the greatest facility over ground so soft that a man can scarcely stand upon it without sinking. Mr. Curtis politely explained the objects of the different parts of the machine; and, so far as an unprofessional person can judge, the principle of the construction appears sound, and we have no doubt that when completed (which it will be in a short time), it will fully answer the purpose.—*Dumfries Courier.*

RECLAIMING LAND FROM THE SEA.—The sea banks at Long Sutton, Lincolnshire, under Sir John Rennie's direction, are now nearly finished. The contractor for the work is Mr. Henry Sharpe.

RAILWAY CHRONICLE OF THE MONTH OF SEPTEMBER.

THIS month has been distinguished by the amalgamation into one concern, of the three midland lines, the North Midland, Midland Counties, and Birmingham and Derby. Special meetings for that purpose were held on the 18th, 20th, and 21st, when resolutions in favour of the scheme were passed almost without opposition. The terms are, that the capital and debt of the united company should be distributed according to the following scheme.

	Capital.	Debt.	Total.
North Midland	£2,905,400	£863,000	£3,768,400
Midland Counties	1,275,000	581,000	1,856,000
Birmingham and Derby ..	978,500	411,000	1,389,500
Total	5,158,900	1,855,000	7,013,900

The shares to be converted into stock, and the profits to be divided *pro rata* except that the Birmingham and Derby is to receive 27*s.* 6*d.* per cent. per annum less dividend. An incidental question arose at the Birmingham and Derby meeting as to the eighths shares which had been issued at a very great discount, but which had not all been called up. The holders of eighths claim that the whole shall be called up to entitle them to the benefits which would have accrued to them had the whole amount of money been required. It was pretty generally agreed that they ought to have £8. 3*s.* 5*d.* per £1. 10*s.* paid up, but what they claim is £10. 18*s.* 11*d.* for £2. 7*s.* 5*d.* paid up. The question is put off till a future date, when it is supposed the holders of eighths will rest satisfied with what they have got. At the Midland Counties meeting the Chairman very clearly showed that that Company would be placed in a more disadvantageous position than it would have been under any of the schemes formerly proposed and rejected. The majority, however, felt that they were obliged to submit to the new terms. The effect of the amalgamation is to create a Company, which adds another to the number of colossal railway institutions, and which stands thus:—

	Capital and Loan.	Length opened in miles.	Annual traffic.
Great Western [1]	£6,670,000	190	£750,000
United Midland	7,013,000	178¼	400,000
London and Birmingham [2] ..	7,000,000	119½	800,000
Grand Junction	2,464,000	119	360,000

It will thus be seen that the London & Birmingham is hard put to it to keep the pre-eminence, and that a number of gigantic companies are being erected in the country, into which all minor lines must sink. Within three years there will be perhaps not more than half a dozen railway companies in the country, and the new system will develop some extraordinary results, particularly as to economy. The saving on the United Midland line is estimated at £30,000 per annum, besides a considerable revenue to accrue from better arrangements of the trains.

The half-yearly reports of the two other companies we gave in our last number; that of the Birmingham and Derby, not then published, presents no very extraordinary results. The estimated amount of savings to be effected was upwards of £7000 a year.

Edinburgh & Glasgow Railway.—This Company have adopted the plan of making up their accounts to the 31st of January, and 31st of July of each year, instead of 31st of December, and 30th of June, by which the half year's accounts made nearly equal in receipts, but the present accounts show 7 months' income and expenditure. The dividend recommended was at the rate of 2¼ per cent. per annum. A junction line was in progress to the Monkland and Kirkintilloch to cost £3000.

Hull and Selby Railway.—This report states a diminution in the passenger traffic, and an increase in the goods, the accommodation for which had required further provision.

Taff Vale Railway.—The Taff Vale meeting was a stormy one, and the more particularly as it was to receive the report of a committee of inquiry into the conduct of the concern. It appeared pretty clearly that the undertaking had been grossly mismanaged, and there appears little prospect of its improvement, for a great part of the capital is held by the proprietors of the neighbouring collieries and iron works, whose interests seem to be opposed to those of the shareholders. The owners require a further reduction in the tolls, and the shareholders require an augmentation of the tolls.

Dublin & Drogheda Railway appears to be progressing favourably, and its success is likely to be the best railway measure for Ireland, by inducing private capitalists to make investments there. A difference having taken place with the Ulster Railway as to the width of rails, it was referred to the Board of Trade, and General Pasley eas recommended a gauge of 5ft. 3 in., a most extraordinary measure, and seemingly not having very powerful arguments for its support. Mr. Mac Neil, C.S., is having about 4 miles laid with permanent rails, on which he means to try some experiments as to the best forms of carriages and engines for working the line. He holds out hopes of some new results.

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[1] The Great Western has a considerable length of line yet to be opened, and the capital and loan do not include the cost of the Bristol & Exeter, Bristol & Gloucester, and Cheltenham & Great Western.

[2] The London & Birmingham has about 47 miles of branch still to open.

South Western.—The accounts of this Company showed a slight increase in the traffic, but the savings in the working expenditure had been counteracted by the great increase in parochial rates. The dividend was 30*s.* per share for the half year. The main features of the discussion which took place were relating to the parochial rates. It seemed to be felt that no other mode of checking this oppression existed than a combined application of the Railway Companies to the legislature for an amendment of the present law in relation to the subject.

Greenwich Railway Company.—After all the meetings chronicled in our last, and the adoption of the mileage principle, a final meeting upset the whole proceedings, and the question of toll remains *in statu quo*, the committee of inquiry being summarily dismissed. The Directors have, however, since offered to the Croydon Company, a modified toll of 4*d.* for each first class passenger, 3*d.* for each second class passenger, and 2*d.* for each third class passenger, which has, we believe been refused, the other companies trusting to the effect of the Bricklayers' Arms branch to bring the Greenwich to their senses.

Manchester and Birmingham Railway.—The dividend recommended here was 15*s.* per share. There had been an increase in the income, and a diminution in the expenditure. The Directors had been making some experiments with cheap fares, which had fully answered their anticipations, and they were about to apply the principle to a greater extent.

Maryport and Carlisle Railway.—This line is not yet finished, and the secretary, a Mr. Mitchell, who was a country school-master, having ousted the engineer, has installed himself in that capacity too, so that the profession is likely to see some strange performances. The traffic, and the whole concern is in a wretched condition, but the reports published do not admit of particulars being given.

Glasgow, Paisley, Kilmarnock & Ayr Railway.—The passenger traffic is reported to have remained stationary, the goods to have advanced. The Kilmarnock branch was opened on the 4th of April; an arrangement with the competing canal company had been effected. The subject of steam boats in connexion with the railway, was recommended to the proprietors, but nothing effective seems to have been done. The proceedings principally relate to this subject, and the means of effecting a saving in the working expenses.

Glasgow, Paisley & Greenock Railway.—The proceedings of this Company at their half-yearly meeting were much the same as those of the preceding. Steam boats had already been taken into connexion with the Company, but further measures were urged.

West London Railway.—The works on this line were reported at the half-yearly meeting to be going on well, and the opening is promised for November. The total disbursements are £174,967.

London and Croydon Railway.—The half-yearly meeting of this Company was marked by a long exposition from Mr. Wilkinson of the conduct of the Croydon Board as to the toll transactions, and the announcement of the Greenwich offer alluded to above. The traffic had of course, in the state of the toll question, shown no improvement.

Manchester and Leeds Railway.—At this meeting a general increase in the traffic was announced, as also an arrangement with the Calder & Kebble Canal Company, which had been competing for the traffic. A complaint was made here also of a great increase in the parochial rates. The dividend was at the rate of 5½ per cent. per annum, and the works on the extension line and Halifax branch are reported as going on well, the Halifax branch to be finished in the spring. Surveys have also been made for branches to Huddersfield, Ashton, Bury and Bradford, which are likely to be prosecuted. This company, it seems, is threatened with a competition by the way of the Sheffield & Manchester from Penistone to Barnsley.

Yarmouth and Norwich Railway.—This company have expended £49,072, and the works are represented as in a forward state, so as to get the line open by June next year. It seems that the estimates are likely to be exceeded by £12,500, in consequence of some landowners' claims which the Company has been obliged to satisfy; at this meeting measures were taken for promoting a line from Norwich to Brandon.

TABULAR STATEMENT FOR THE HALF YEAR, DECEMBER 31, 1842, TO JUNE 30, 1843.

RAILWAYS.	....	....	RECEIPTS.			PAYMENTS.							....
Names.	Lgth in mls.	Total Expenditure.	No. of Passgrs.	Passgrs.	Goods.	Total.	Locomotive Power.	Carriage Dep.	Maintenance of way	Office Department	Taxes and Rates.	Total Charges.	Interest.	Profit.
		£		£	£	£	£	£	£	£	£	£	£	£
Greenwich [1]	3¾	1,030,108	705,204	21,343	..	26,587	3,500	3,490	1,044	1,551	3,304	13,957	11,550	1,080
Grand Junction [2]	88¾	2,375,134	..	132,976	49,652	185,093	20,298	29,692	12,675	4,591	2,954	80,320	..	104,772
Manchester and Bolton	10	777,956	139,408	11,571	6,293	17,811	1,095	3,110	732	754	268	5,959	5,282	9,008
North Union	22	613,212	..	17,731	6,793	25,337	1,466	2,142	1,471	1,236	1,082	7,397	3,249	14,690
Chester and Birkenhead	14½	509,810	..	11,491	1,298	13,307	2,110	2,382	1,089	237	172	5,990	2,525	2,837
Leeds and Selby [3]	20	..	99,782	3,756	8,158	11,914	..	1,251	567	444	477	2,739	..	9,175
Brighton [4]	56	2,792,193	..	65,487	9,002	74,490	9,168	18,150	4,980	3,417	3,003	49,827	43,974	..
North Midland	72	3,424,766	..	56,551	46,263	102,814	10,267	13,922	9,012	1,400	2,659	36,760	21,200	44,854
Northern and Eastern Counties [5]	32	887,055	..	31,853	3,693	35,547	6,702	6,945	2,033	..	895	20,324	5,695	10,875
London and Birmingham [6]	112½	5,953,831	..	306,457	84,735	389,658	32,854	41,141	22,451	5,645	8,747	112,238	39,680	223,924
Midland Counties	57½	1,725,693	..	40,421	21,064	62,324	10,780	9,498	7,105	3,383	1,378	32,144	12,813	17,367
Great North of England	74	1,230,604	64,177	19,754	13,225	32,979	2,830	3,497	3,700	1,844	1,184	12,355	14,202	7,000
Sheffield and Rotherham [7]	5¼	..	185,234	7,040	953	8,116	..	2,107	486	371	420	3,384	1,199	3,578
Bolton and Preston	14½	373,925	..	3,846	1,468	5,315	2,000	1,170	185	..	92	3,447	..	1,867
Great Western [8]	118¼	6,651,928	725,127	254,603	75,400	330,003	33,403	54,640	23,985	4,118	8,592	159,232	86,836	82,886
Liverpool and Manchester	51	1,578,601	225,728	60,752	48,217	108,960	10,182	27,698	4,440	2,193	3,608	48,121	3,777	57,062
Blackwall	3¾	1,289,080	..	17,351	927	18,505	..	..	600	..	1,498	15,385	5,553	..
Eastern Counties	50½	2,718,620	999,683	..	..	43,182	4,551	3,741	2,552	1,284	1,520	20,355	2,116	20,710
Birmingham and Glo'ster	55	1,470,730	..	35,514	7,104	42,618	7,968	6,956	6,444	1,290	382	26,045	13,633	4,266
York and North Midland	27¾	673,056	165,627	26,369	13,388	45,163	5,846	5,145	1,177	462	974	13,604	3,958	27,600
Birmingham & Derby	48	1,173,158	..	19,194	9,794	29,282	6,015	6,701	3,676	2,296	729	19,418	7,542	2,323
Edinburgh & Glasgow	46	1,569,887	318,682	41,225	18,584	60,809	5,687	11,328	3,756	1,429	333	22,535	12,168	26,106
Hull & Selby	31	627,626	80,549	12,359	13,668	26,027	3,490	5,027	1,893	937	704	12,043	5,064	9,910
South Western [9]	92¾	2,588,983	..	116,700	26,326	143,523	18,451	27,859	13,579	..	5,238	65,128	15,827	69,386
Manchester & Birmingham	40	1,890,640	..	37,673	6,644	50,149	3,516	8,175	1,345	1,787	1,477	16,301	13,254	20,593
Maryport & Carlisle [10]	28	..	..	584	3,090	3,675	..	..	..	..	..	11,588	2,053	33
Glasgow & Ayr [11]	51	1,029,662	475,012	22,191	8,181	30,372	..	..	..	..	..	15,451	7,204	9.328
Glasgow & Greenock	22½	635,512	..	20,176	6,853	27,029	..	..	..	..	..	17,042	6,173	6.215
Croydon [12]	8¾	672,630	402,443	..	..	20,922	..	6,145	2,452	1,173	390	10,160	4,629	9.166
Manchester & Leeds	51	3,125,696	552,639	56,951	53,640	112,523	12,758	13,793	6,751	2,085	5,141	40,528	35,747	36,248
Hartlepool [13]	15	..	..	..	..	44,708	..	..	..	..	..	24,529	..	20,116

[1] Greenwich Railway received for foot passengers £497, and toll £4,746. [2] Grand Junction paid Liverpool and Manchester Railway £8,016, and for rent £2,093. [3] Leeds and Selby locomotive power is included in York and North Midland. [4] Brighton paid Croydon and Greenwich Railway for toll £11,109. [5] Northern and Eastern paid Eastern Counties Railway for toll £3,749. It should be observed that the office expences cannot be separated. [6] London and Birmingham paid Aylesbury Railway for rent £1.250. In addition to the total outlay there is the sum of £13,966 carried to the depreciation fund. [7] Locomotive power not kept distinct. [8] Great Western paid Bristol and Exeter and Cheltenham Railway for rent £34,484. In addition to the outlay £5,000 is carried to the depreciation fund.

[9] The carrying and office or general department cannot well be separated in the South Western Company. [10] The accounts of the Marypool and Carlisle Company do not allow further information to be given. [11] Part of the Glasgow and Ayr, and Glasgow & Greenock being a joint line worked in common, it is impossible to divide the items of expenditure. [12] The Croydon accounts being divided into a toll account and a traffic account, the table of income cannot be divided. [13] The Hartlepool accounts have not been published.

Northern and Eastern Railway.—A meeting of this Company has been held for the purpose of authorizing a loan of £67,822 for the extension to Newport. At this meeting it was announced that measures were in progress for an extension to Brandon, so as to make a complete line from London to Norwich and Yarmouth.

REGISTRATION OF DESIGNS ACT.

A NEW act of Parliament came into operation on the first day of September last, which promises to be of some benefit for many purposes, but not to that extent, we think, which some of our contemporaries imagine, as the articles only obtain a protection so far as the *configuration* goes. The act does not in any way protect a principle; therefore, if the article manufactured partake of the form of a circle, and another article for the same use be made in the form of an ellipsis, there will be no protection. The following is the principle clause of the act:—

"And with regard to any new or original design for any article of manufacture having reference to some purpose of utility, so far as such design shall be for the shape or configuration of such article, and that whether it be for the whole of such shape or configuration or only for a part thereof, be it enacted, That the proprietor of such design not previously published within the United Kingdom of *Great Britain* and *Ireland* or elsewhere shall have the sole right to apply such design to any article, or make or sell any article according to such design, for the term of three years, to be computed from the time of such design being registered according to this Act; provided always, that this enactment shall not extend to such designs as are within the provisions of the said Act, or of two other Acts passed respectively in the thirty-eighth and fifty-fourth years of the reign of His late Majesty King George the Third, and intituled respectively *an Act for encouraging the art of making new models and casts of busts, and other things therein mentioned, and an Act to amend and render more effectual an Act for encouraging the art of making new models and casts of busts, and other things therein mentioned.*"

The following is the TABLE OF FEES *which since the passing of the Act have been authorized by the Lords Commissioners of the Treasury.*

	Stamp.			Fee.			Total.		
	£	*s.*	*d.*	£	*s.*	*d.*	£	*s.*	*d.*
Registering Design	5	0	0	5	0	0	10	0	0
Certifying former Registration	5	0	0	1	0	0	6	0	0
Registering and Certifying Transfer	5	0	0	1	0	0	6	0	0
Cancellation or Substitution				1	0	0	1	0	0
Inspecting Index of Titles				0	1	0	0	1	0
Inspecting Designs (expired Copyrights) each volume				0	1	0	0	1	0
Taking Copies of ditto, each Design				0	2	0	0	2	0
Inspecting Designs (unexpired Copyright) each Design				0	5	0	0	5	0

We know not upon what authority a £5 stamp is inflicted by the Lords Commissioners, not one word in the act authorises it; we therefore contend, that they have no power to order one to be affixed, and that if the Registrar refuses to register a design without the £5 stamp, upon the fees being tendered, he will, no doubt, render himself amenable to the law for damages, and that, if an application be made to the Court of Queen's Bench, it will grant a *mandamus* to compel him to register and certify.

LIST OF NEW PATENTS.

(From Messrs. Robertson's List.)

GRANTED IN ENGLAND FROM AUGUST 31, TO SEPTEMBER 28, 1843.

Six Months allowed for Enrolment, unless otherwise expressed.

Charles Louis Felix Franchot, of Arundel-street, Middlesex, engineer, and Cyprien Marie Tessié du Motay, of Arundel-street aforesaid, gentleman, for "*an improved method of connecting and laying pipes or vessels beneath the surface of water, for the purpose of forming therewith tunnels or viaducts for the conveyance of passengers and goods.*"—August 31.

George Catlin, of Queen-square, Bloomsbury, Middlesex, artist, for "*improvements in the construction of vessels for navigation, designed to prevent the loss of life in cases of shipwreck or other accidents at sea.*"—September 4.

William Thomas, of Cheapside, merchant, for "*an improved fastening for wearing apparel, and which may also be applied as a fastening to portmanteaus, bags, boxes, books, and other things.* (A communication.) September 6.

Alexander Spears, of Glasgow, merchant, for "*improvements on or appertaining to, glass bottles proper for wines and other liquids.* (A communication.) September 6.

Pierre Pelletan, of Fitzroy-square, Middlesex, Esq., for "*improvements in the production of light.* September 6.

William Denly, of Hans-place, Sloane-street, bricklayer, for "*improvements in the construction of fire-places, flues, and chimneys.* September 21.

John Baptist Wickes, of Leicester, framework knitter, for "*improvements in machinery employed in the manufacture of framework knitted and looped fabrics.* September 21.

George Robert D'Harcourt, of Argyll-street, Middlesex, gentleman, for "*improvements in sorting, checking, and delivering letters, newspapers, and other articles.* September 28.

Omitted in last month's list.

John Charlton, of Birmingham, factor, for "*improvements in castors for furniture.* August 17.

MISCELLANEA.

MIDLAND COUNTIES RAILWAY.—The platform across the Trent at the Weir, building by the Midland Counties Railway Company, has all been carried away by the floods; the works are going on slowly, and in a different manner from the first operations.

CANALS IN FRANCE.—A canal is now in progress in the south of France, under the direction of Mr. Thomas Woodhouse, C.E., formerly resident engineer on the Midland Counties Railway.

MANUFACTURE OF BRICKS.—A description of brick is made in the neighbourhood of Nottingham called copper mould. They are compressed after partial drying in hacks; the arris is very sharp, and equal to dressed bricks.

DERBY DRAINAGE.—The Commissioners intend to apply to Parliament for a new Improvement Act, and several plans have been proposed for improving the drainage, relieving the town from flood waters, and improving its present dangerous and unhealthy state. Two reports have been published, one by Mr. Harrison and another rather lengthy by Mr. John Roe, Assoc. Inst. C. E.

STEAMERS ON THE TRENT.—A twin boat is building at Lenton, to ply between Nottingham and Gainsborough, to carry both goods and passengers,

NEWCASTLE-ON-TYNE. An opposition boat is to start between here and London to compete with the General Steam Navigation Company, the fare to be 30*s.* instead of as at present 42*s.*

EDINBURGH.—A tunnel is being driven from the present terminus of the Newtyle Railway to the centre of the market place; and a line has been projected to Berwick, under the auspices of Messrs. Grainger and Miller, engineers.

DUNDEE.—The east church adjoining the Steeple Kirk, which was burnt to the ground about two years ago, is now beautifully restored, and will be shortly opened for use; it is in the florid Gothic style, and of excellent workmanship.

SIR WALTER SCOTT'S MEMORIAL.—It is now completed to a short distance above the arches, which carry the cross or about one-third of the whole height; the situation, on the south side of Princes Street, is well chosen, and when complete it will be the boast of Scotland as to masonry.

INCORPORATED COMPANIES.—At the head meeting day of the company of house carpenters, a vote of thanks was passed to Mr. Henry Glynn, for a present of five pounds worth of books, being the *Civil Engineer and Architect's Journal* from its commencement in 1837.

ST. JAMES'S PALACE.—We understand that the whole suite of State apartments, at St. James's Palace, is about to undergo an extensive and thorough repair, cleansing, and decoration. It is expected that the apartments will not be again ready for royal use for several months, probably not until the early part of next spring.

THE PRINCESS ALICE.—A new iron steamer, built by the well known firm of Messrs. Ditchburn and Mair of Blackwall, for the Folkestone and Boulogne station made a trial down the river Thames, on the 2nd ult.; she is 12ft. long, 20 ft. beam, and draws 6 ft. 6 in. of water, and is built with water-tight bulk heads, as all steamers ought to be; her lines are very fine and of that form which is sure to obtain a good velocity. The engines are 120 horse power collectively, and have the annular cylinders patented by Mr. Joseph Maudslay, drawings of which are to be found in our *Journal* for 1841, Vol. 4, p. 369. The object of this form of engine is to obtain direct action and a long stroke, but we are no admirers of the principle, nothing but the superior workmanship of the firm of Messrs. Maudslays & Field could ensure its working; in such an exposed station as crossing the channel she will have some rough work to encounter. The wheels are 19 ft. 3 in. diameter to the extreme edge of the boards, they are a modification of Morgan's wheels, excepting they have three of the boards connected in such a manner that by the aid of an eccentric on the shaft, the paddle boards enter and leave the water vertically; these wheels are similar to those fitted on board the "*Victoria and Albert.*" There is another addition to these wheels which we understand Messrs. Maudslays have fitted to other vessels, consisting of an iron ring of the same diameter as the rim of the wheel; it is fixed on the inner side of the wheel; this ring is jagged, and formed like a thin cog wheel, and is turned by means of a pinion worked by one or two men on deck to each wheel; by this means a vessel might be got ont of dock without getting up the steam. At the trial of the vessel the engines made 30 to 31 strokes per minute, and it is stated to have obtained a rate of 14 miles per hour. Her engines are fitted with an alarum whistle which we have seen adopted vt some of our provincial ports.